From the history of the creation and development of field rocket artillery in the USSR during the Great Patriotic War

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The Great Patriotic War gave a powerful impetus to the development of various fields of scientific and technical knowledge. One of the practical innovations in the Red Army was the formation and development of a new type of weaponry - rocket artillery, the prerequisites for the emergence of which lie in the development of rocketry, automotive, chemistry and other fields of science and technology.

The article presents well-known, little-known and declassified data on the prerequisites for the appearance and development of rocket artillery in the USSR during the Great Patriotic War.

In the 20s and 30s, a wide range of work was carried out in the USSR to create shells and means for their launch. According to the latest data, since the beginning of the 30s, work has been carried out in Russia on the capabilities of the salvo launch of rockets.

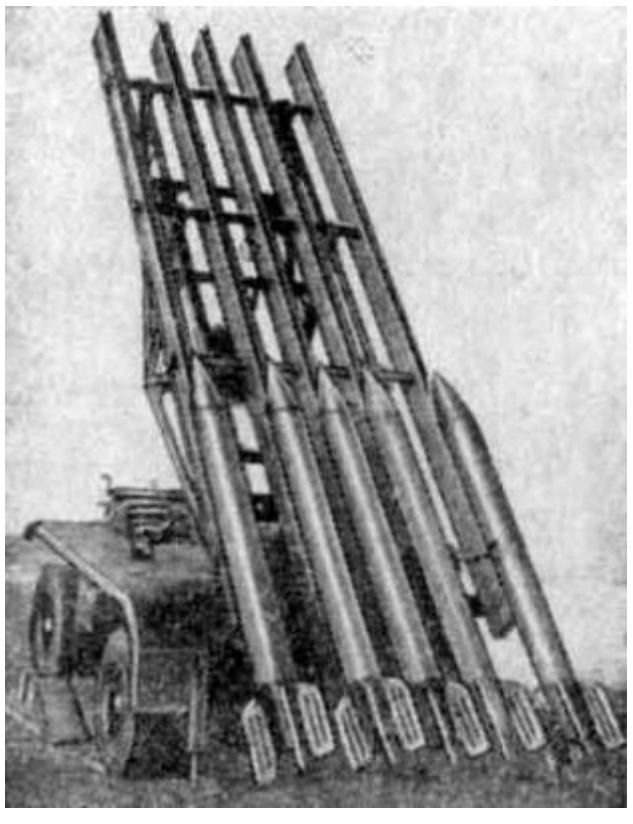
Initially, in 1933, specialists from the Gas Dynamic Laboratory, and in 1936, it was proposed to provide salvo fire by using pin launchers, each of which was packed with one projectile. The pins along with the shells were transported in the bodies of trucks. After installing them on the ground close to each other, one of them was mounted in the back of a car. The vehicle was used to transport ammunition and "launch tripods" [1], [2].

In his book "Jet Armament of the Soviet Air Force" S.N. Reznichenko writes: “On October 15, 1936, the deputy chief of the KhIMU of the Red Army, Divisional Commander M.I. Stepanov held a meeting to clarify the TTT for self-propelled installations for transporting and firing chemical missile projectiles from them, as well as for launching pins for firing from the ground 245-mm RHS.

As a result of the negotiations, both parties considered it necessary to draw up TTT for self-propelled units for the above purposes, as such based on ZIS-6, ZIS-5, GAZ-AA vehicles.

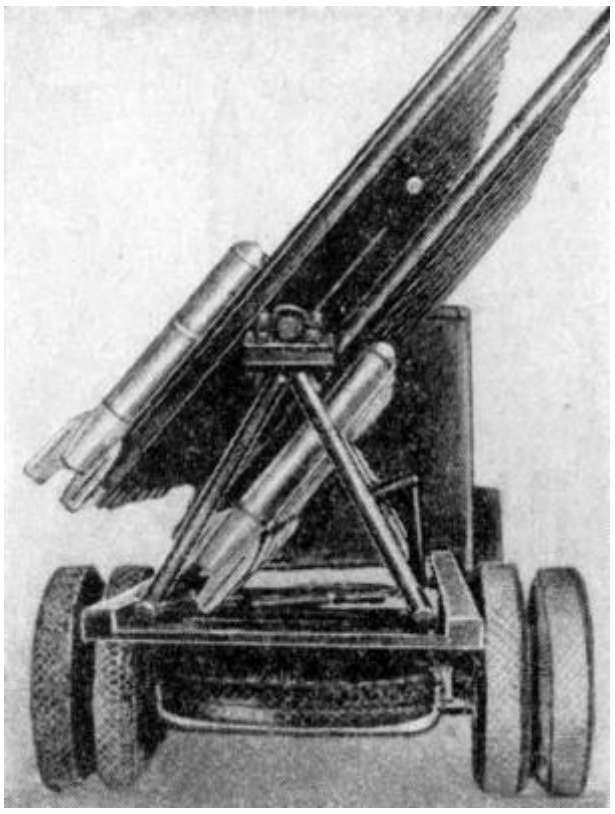
G.E. Langemak offered only to deliver ammunition on a wheeled chassis to the position and, using the EE lifting mechanism, mechanically load the pins installed on the ground for launching RHS-245 and RHS-203 shells. The transcript of the meeting indicated the following: “Due to the lack of experience in conducting group shooting with pins, suggest that the RNII make 10 pins for testing the RHS-132 in 1936 and include an item on conducting the corresponding test in the program” [3].

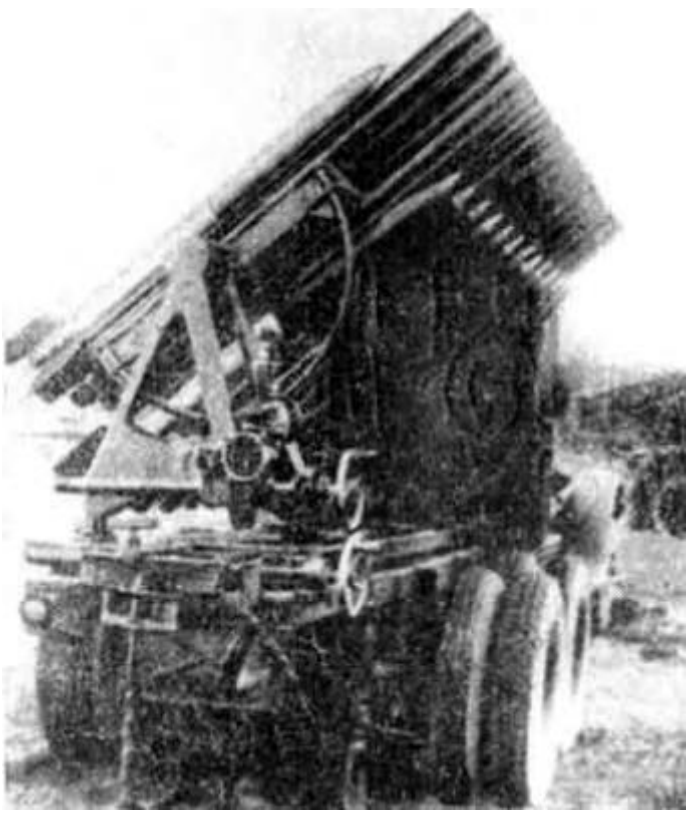
In the period 1937-1941, employees of Research Institute No. 3 (formerly RNII - Jet Research Institute) carried out work on ballistic unguided missiles with inclined launch. The weight of the 521 rocket was 200 kg. A 10-round launcher with a rail length of 10 meters was proposed for launch. The estimated range of the projectile was 23 km [4].



INSTALLATION FOR LAUNCHING MISSILES 521

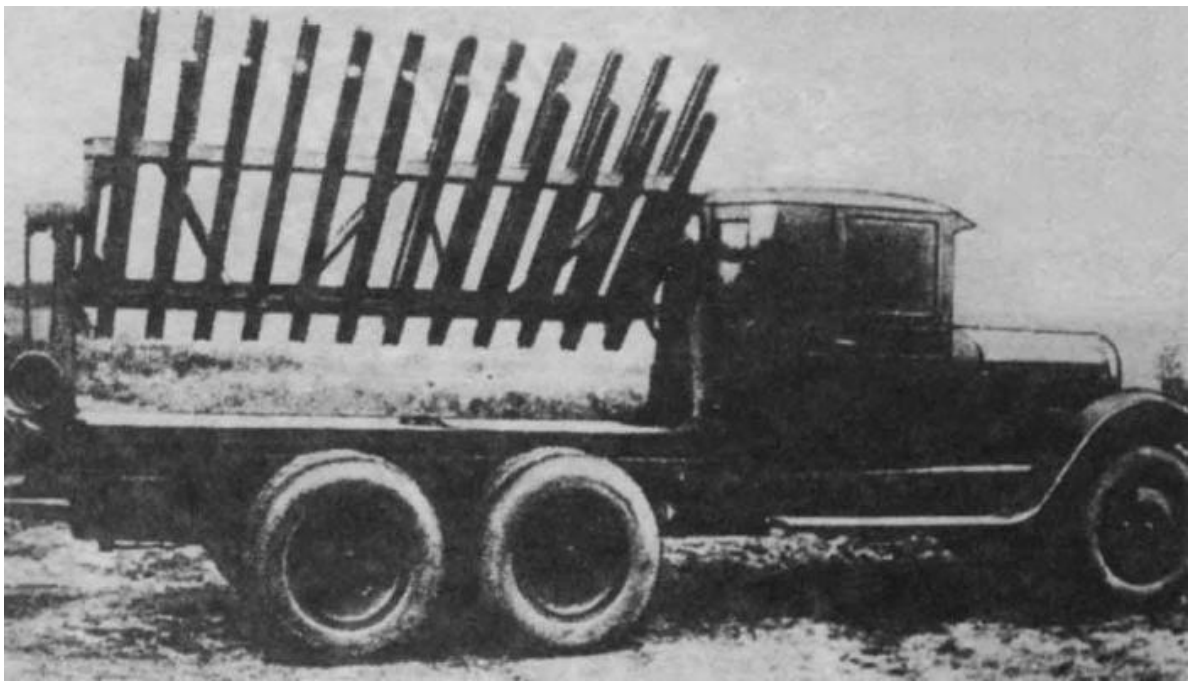
In October 1938, the designers of Research Institute No. 3 A. G. Kostikov, A. P. Pavlenko and A. S. Popov developed a project for a 24-round self-propelled launcher for firing unguided rockets of 132 mm caliber based on aircraft RS-132. The launcher, according to modern terminology - the artillery unit, was mounted on a modified chassis of a ZIS-5 truck. The projectile unit consisted of a unit with 24 single-bar groove-type guides fixed on a special frame in the transverse plane of the machine. From December 8, 1938 to February 3, 1939, field tests of installations and shells manufactured in the workshops of Research Institute No. 3 were carried out. The installation was presented for testing unfinished and could not stand them. During the tests, a large number of failures were found during the descent of shells due to imperfection of the corresponding units of the installation (39 failures in 223 launches); the process of loading the launcher was inconvenient and took a lot of time (45 minutes when working with four or five numbers); swivel and lifting mechanisms did not provide easy and smooth operation, sights - the required targeting accuracy. The ZIS-5 truck had limited maneuverability.





24-CHARGER FOR RS-132 (1938) AND 24-CHARGER FOR RS-132 (1939).

Two variants of experimental installations on a modified chassis of a ZIS-6 truck for launching 24 and 16 unguided rockets of 132 mm caliber were developed by employees of Research Institute No. 3 in 1939.



The main difference between the installation of the II sample and the installation of the I sample was the longitudinal arrangement of the guides. From September 28 to November 9, 1939, field tests of the installations were carried out. The tests were led by military engineer N.N. Kuznetsov [5]. Based on the results of field tests, it was decided that the installation of the I sample, due to technical imperfections, could not be admitted to military tests. Installation II of the sample, in the design of which a number of serious flaws were also found, could be admitted to military trials after significant design changes. During the tests, the following disadvantages were identified:

- when firing, the installation of the II sample swings;
- the incidence of the elevation angle reaches 15'30 ", which in turn entails an increase in the dispersion of shells;
- when loading the lower row of guides, a projectile fuse may hit the truss structure.

Since the end of 1939, the main attention of specialists has been focused on improving the scheme and design of the installation of the II sample and eliminating the shortcomings identified during field tests. The directions in which the work was carried out were as follows: firstly, work continued to eliminate the shortcomings of installation II, and secondly, work was carried out to create a more advanced installation, which differed from the installation of sample II. The tactical and technical assignment for the development of a more advanced installation ("modernized installation for the RS" in the terminology of documents of those years), signed on December 7, 1940, provided for:

- carry out constructive improvements to the lifting-slewing device;
- increase the angle of horizontal guidance, simplify the sighting device;

It also provided for:

- increasing the length of the guides to 6000 mm and 7000 mm instead of the existing 5000 mm;
- the ability to fire unguided rockets of 132 mm and 180 mm caliber.

In the book "Ground missile equipment" it is indicated that "The finally developed designs of launchers were re-tested on June 7, 1939. On December 25, 1939, the launchers and missiles for them were approved, and in February 1941, the final decision was made on the manufacture of an

experimental series "[132].

On April 25, 1941, tactical and technical requirements No. 1923 were approved for the modernization of a mechanized installation for firing rockets.

At the beginning of 1941, the distribution of orders to enterprises began. Although the shortcomings discovered during field trials in 1939 were not eliminated, for military trials in early 1941, the Main Artillery Directorate of the Red Army ordered the manufacture of an experimental batch of experimental upgraded installations for the RS-132. However, the transfer of an order for the manufacture of a pilot batch to the Voronezh plant named after The Comintern of the People's Commissariat of General Machine Building in February 1941 did not mean that the installation had already been put into service and that its serial production had begun. Taking into account the design and technological changes, the drawings of the general view of the pilot plant, developed by the specialists of the design bureau of the plant. Comintern, were ready by June 10, 1941.

One of the six installations made at the Voronezh plant was sent for military tests near Sevastopol for firing 140-mm rocket lighting parachute shells in the interests of coastal artillerymen. With the beginning of the war, data about it are lost.

It was established that on March 28, 1941, addressed to the Chairman of the GAU Artillery Committee, with a copy to the head of the technical department of the NKB from Research Institute No. 3, signed by A.G. Kostikov and I.I. Guay was sent a letter on the approval of the tactical and technical requirements for the towed anti-aircraft missile system. The caliber of the projectile is 132 mm, the number of projectiles launched is 16, towing by a ZIS-6 truck, a Kommunar or Comintern tracked tractor.

“At the beginning of 1940, NKB Scientific Research Institute No. 3 received a proposal to use missile shells for the purpose of setting up barrage anti-aircraft fire.

This proposal was sent by us to the Artillery Committee.

In 1940, Research Institute No. 3 did not receive a definite answer from the Artkom about the need to have this type of weapon as an aid for the general air defense system.

On the initiative of Research Institute No. 3, a prototype of an anti-aircraft missile system and missile shells were tested at NIZAP, and on which a report was drawn up by the test site / one of the copies of the act is in Artkom under No. 789 /.

In its conclusions, NIZAP speaks of the expediency of this work, subject to an increase in the RS ceiling and a decrease in flight time.

Based on the tests carried out, deputy. At the beginning of April 1941, the head of the 2nd department of the Artkom, military engineer 1st rank Comrade GÜNER and Research Institute No. 3 of the NKB, drew up tactical and technical requirements for proactive work on an anti-aircraft missile system, a rocket, a tube and an installer.

May 12, chaired by the deputy. Chairman of the Artkom, Colonel Comrade ZASOVA, a meeting was held to consider TTT with representatives from the Artkom, Directorate 3.A. Artacademy them. Dzerzhinsky, Research Institute No. 3 of the NKB of Plant No. 398, where they spoke for and against the continuation of work on RZU ”. Also, the tactical and technical requirements for the "RZU" anti-aircraft missile launcher, which was being worked out by Research Institute No. 3 on its own initiative, were considered.

Representatives of Research Institute No. 3 left the meeting without any definite result, not knowing whether this work was expedient in the future or not.

" *Research Institute No. 3 asks the Artillery Committee to give a final decision on this issue and, if it is advisable to conduct such work, give more detailed tactical and technical requirements for it* ." It is written by hand on the document: “ *At the meeting it was clearly stated that with the proposed ballistics and accuracy it would be inappropriate to make an RPM. We need to work on the rocket to improve the ceiling and accuracy* . ”

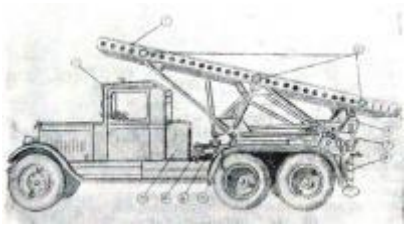
Also in the document TsAMO RF indicates “ *At the meeting it was established that the design of*

the" RZU "complete with PUAZO, power synchronous transmission and tube installer before the development of a full-fledged missile projectile are inexpedient. Research Institute No. 3 of the NKB firmly, confidently in the viability of its proposal based on further possible prospects for the development of rocket technology"[6].

The further fate of the project is unknown. During the war, other versions of anti-aircraft installations were also worked out, but there is no clear information about their practical use. Today it is already obvious that, being unguided, the shells could not and cannot provide the required accuracy, and it was and is inappropriate to ensure the defeat of fast-flying air targets due to the high density of shells.

From June 15 to June 17, 1941, at the Sofrinsky training ground near Moscow, a demonstration of new weapons was held to the leaders of the Communist Party and the government. Among them were experimental samples of the installation for launching unguided rockets of 132 mm caliber. Based on the results of the review on June 21, 1941, it was decided to organize the production of installations and unguided rockets for them. The adoption of such a decision is explained by the threat of an impending war, and in no case did this mean the adoption of a model, since it was not ready either for mass production or for operation in the troops. With this decision, the first stage, the pre-war stage, was completed and the second, the military stage, began. Its beginning is determined by the connection to the completion of the creation of the installation for launching unguided rockets of 132 mm caliber. Warhead type - high-explosive fragmentation. The work was carried out by specialists of the Moscow plant "Compressor" and its Special Design Bureau (SKB), which from that moment until the end of the war became the head enterprise for the improvement and development of new installations for launching rockets, and the plant "Compressor" - for their introduction into production and manufacturing. Also, until the end of the war, they were the main experimental base of the Main Armament Directorate of the Guards Mortar Units of the Red Army since its formation in September 1941, after it was separated from the Main Artillery Directorate of the Red Army [7]. which from that moment until the end of the war became the leading enterprise for the improvement and development of new installations for launching rockets, and the Compressor plant - for their introduction into production and manufacture. Also, until the end of the war, they were the main experimental base of the Main Armament Directorate of the Guards Mortar Units of the Red Army since its formation in September 1941, after it was separated from the Main Artillery Directorate of the Red Army [7]. which from that moment until the end of the war became the leading enterprise for the improvement and development of new installations for launching rockets, and the Compressor plant - for their introduction into production and manufacture. Also, until the end of the war, they were the main experimental base of the Main Armament Directorate of the Guards Mortar Units of the Red Army since its formation in September 1941, after it was separated from the Main Artillery Directorate of the Red Army [7].

The book "Ground missile equipment" provides data that "on June 21, 1941, that is, a few hours before the invasion of the fascist hordes into our homeland, after examining a prototype series of launchers and M-8 and M-13 missiles by members the government and representatives of the command of the Red Army were instructed to deploy the serial production of powder rockets and launchers BM-13, as well as the completion of launchers BM-8 "[132].



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MECHANIZED INSTALLATION, II SAMPLE ON THE MODIFIED CHASSIS OF THE ZIS-6 TRUCK
1 - PACKAGE OF GUIDES, 2 - SIDE MEMBERS, 3 - TRUSS, 4 - SWING FRAME, 5 - LIFTING MECHANISM, 6 - SWING MECHANISM, 7 - SIGHT, 8 - JACK, 9 - PROTECTION, 10 - GAS TANK "

On the basis of the Directive of the Commander of the Moscow Military District No. 10864 of June 28, 1941, the formation of the first units of field rocket artillery began on that day. From June 28 to July 1, 1941, the first battery of mechanized installations was formed on the basis of the Krasin 1st Moscow Red Banner Artillery School. The battery consisted of: a command platoon, three fire platoons, a combat power platoon, a sighting platoon, an economic department, a fuel and lubricants department, a medical unit, and there should have been seven M-13 installations. In

order to transport ammunition, fuel and lubricants and food, the battery consisted of 44 trucks, with the help of which it was possible to transport 600 M-13 shells, 100 rounds for a 122-mm sighting howitzer, three gas stations for fuel and lubricants and up to seven daily food cottages. All

these funds and installations were concentrated in the school. Two combat installations were not received and the battery went to the front with five installations and one 122-mm howitzer of the 1910/30 model of the year as a sighting gun carried in the back of a car.

On the night of July 1-2, 1941, the battery under the command of Captain I.A.Flerov went to the front from Moscow along the Minsk highway along the Mozhaisk-Yartsevo-Smolensk route. On July 4, 1941, the battery became part of the artillery of the 20th Army [8], [9].

According to other sources, a battery of seven combat units went to the Western Front on the night of July 3, 1941. With the battery, the engineers of NII-3 A.S. Popov and D.A. Shitov. They were engaged in training personnel to manage new weapons during daytime breaks [10]. According to the source [10], the following entries appeared in the battery's combat log: " *07/14/1941, 3:15 pm. They struck the Nazi echelons at the Orsha railway junction. The results are excellent. A continuous sea of fire* ." " *07/14/1941 16 hours 45 minutes. A salvo on the crossing of fascist troops through Orshitsa. Large losses of the enemy in manpower and military equipment, panic. All the Nazis who survived on the eastern bank were taken prisoner by our units ...* ".

The archival document of GAU KA dated July 19, 1941 on the use of rocket launchers provides information that clearly does not indicate Flerov's battery, but the results of the analysis of the available information published above allow us to draw such a conclusion.

" *A special battery of rocket launchers was formed according to the directive of the Moscow Military District No. 10864 of 28.641 and 2.7.41, directed in a marching order to the western direction.*

The battery arrived in Smolensk by 8:00 a.m. on 4.7.41.

One day was given to align the battery and on 6.7.41 at 5h30. the battery appeared to occupy the battle formation, on the 502 km of the Moscow-Minsk highway, in the defense system of the 73rd rifle division, the 20th army. A study of the situation in the division's sector showed that the use of a battery in this sector was inappropriate. On firm insistence, the battery was sent to the 18th and 73rd Rifle Division to cover the city of Orsha. 14.7.41 at 15h15m. the first salvo (96 shots) was fired at the accumulation of enemy tanks and infantry in the area of the central station of the city of Orsh and at 17.20. a second salvo (94 shots) was given along the crossing of the Dnieper river. The results of the shooting: at the station - a volley covered the area of the station and caused a big fire; on the crossing - the 6th company of the 413th joint venture observed the shooting and reported that the crossing was covered with a volley. Information about the results at the headquarters of the 20th army and the headquarters of the front to from "ride could not be obtained. 15.7.41. the battery was 23 km away. sowing west Smolensk received a task at the headquarters of the 20th army.

Preparation and condition of the material part - after a long march (about 700 km, of which 130 km. The system was in a charged state), all systems turned out to be quite combat-ready, with the exception of one which had an internal gust of the central cable. The system is operational after firing.

Disadvantages discovered during operation and combat firing:

1. *The impossibility of building a fan, because sights do not allow to mark and observe to the right.*
2. *Poorly protected: driver's cab, radiator, gas tank, fire control wires, ramps with tires).*
3. *No lighting for firing at night.*
4. *There is no device for towing installations.*
5. *No "spare parts".*
6. *There is no room for the installation personnel.*
7. *There are no means of transport for the platoon leader.*
8. *The battery is not protected against air attack.*
9. *Fire control hose for 50 m. is superfluous - control is always carried out from the cockpit.*
10. *Insufficient number of voltmeters (you need three per battery), spare squibs (you need 10 pieces per 100 shots), fuses (you need 4 pieces per 100 shots).*
11. *Insufficient horizontal angle of fire (22 °).*
12. *Poorly protected levels (one burst on the first volley)*

12. *Poorly protected levels (one burst on the first volley).*
13. *The design for the "removable mechanism" requires improvement (put on ball bearings or make a sector type).*
14. *The control panel is weakly strengthened.*
15. *The supporting legs are weak and inconvenient to use (three plates broke off and one leg bent).*
16. *The sight is weakly strengthened (the sight mount does not hold) and the drum (rotates).*
17. *The sights are very high and make it difficult to aim the gun.* ".

The conclusions stated the following: " *The combat use of rocket launchers showed that they are a powerful means of suppressing the enemy, creating a moral impact on the enemy and raising the morale of their troops.*

Rocket launchers must be adopted by the Red Army. In the process of manufacturing new installations, take measures to eliminate these shortcomings. "[eleven].

The results of a modern study on the actions of the battery I.A. Flerov in the period considered above, see the article by E.E. Navogonskiy " Orsha Echo" Katyusha " .

The report on the numerical strength and combat strength of the 20th army as of July 20, 1941 does not clearly indicate Flerov's battery, but, presumably, it is precisely about it. The name of the parts and connections - Special battery RGK. In the section "by state" there are dashes everywhere. The section "according to the list" contains the following data: Command personnel - 9; Political staff - 1; Technical staff - 2; Adm.-household. composition - 1; Medical staff - 1; Total - 14. Junior command personnel - 34; Privates - 150; Total military personnel - 198. Cars: Cars - 1; Freight - 44; Special - 7 (presumably we are talking about installations M-13); Rifles and carbines - 88; Automatic rifles - 50; Light machine guns - 4; Cannons: 210 mm - 7; Howitzers: 152 mm - 1; Radio stations: 6-PC - 2 [12].

The source [12] on sheet 177 contains the following information about the RS battery. What kind of battery is in question in the document is not indicated.

" *Comrade Belokoskov detained Vyazma.*

Point the battery immediately (word crossed out battery - author of the article.) *RS Vadino will be sent to us by Kalinin's representative for use in his group. Highlight the accompanying battery* (the word battery is crossed out and inserted - approx. By the author of the article - the *operational commander -) who knows the route for quick delivery. Deliver the execution. Commander-in-Chief* ". The signature is illegible. The document is written in pencil. The date is not specified [13]. Researcher of this issue Alexander Milyutin (Russia, Moscow) came to the conclusion that this paragraph is about Kuhn's battery, and not about Flerov's battery (TsAMO RF.F. 208.Op. 2511. D. 2.L. 171; TsAMO RF. F. 208.Op. 3038ss. D. 24. L. 96. Original text at URL: http://bdsa.ru /documents/html/donesaugust41/410805.html).

In a copy of the report of the Deputy Head of the Main Artillery Directorate of the Red Army, Military Engineer 1st rank Aborenkov to the Secretary of the Central Committee of the All-Union Communist Party / b / comrade Malenkov G.M. from August 21, 1941, data on the malfunction of all four combat vehicles in Flerov's batteries are given. " *... On the report of the battery, Comrade FLEROVA all of his four combat vehicles require major / factory / repair. They urgently need to be replaced with new ones "*[14].

In a copy of the letter No. 42509as Spets.Artvooruzh. of August 28, 1941 "On the issue: replacement of the material part" from the Deputy Chief of the GAU spacecraft, military engineer 1st rank Aborenkov, to the Commander of the M-13 ARVK battery, Captain Comrade Flerov stated:

"With this, four combat vehicles (M-13) and 16 ZIS-5 trucks with 480 shells for the M-13 are sent to your disposal. *One hzs (looks like hzs because it is written by hand. Should be lzs. Approx. the author of the article) and one type A flyer* .

Send all M-13 combat vehicles you have with a responsible escort to the Compressor plant (Moscow).

All personnel accompanying the car should be returned back.

Report the replacement of vehicles and the arrival of ammunition to the battalion commander and the front line.

The LZS and the "A" type flyer should be placed at the disposal of the captain's battalion Comrade

Smirnov. "The document was printed on August 27, 1941. App. Roslyakov. [15]

In a copy of the report of the Deputy Chief of the Main Artillery Directorate of the Red Army, Military Engineer 1st rank Aborenkov to the Secretary of the Central Committee of the All-Union Communist Party / b / comrade Malenkov G.M. dated 30.08.1941, signed by Aborenkov and the Military Commissar of the OSAV GAU SC Regimental Commissar Lapaev, it is reported: " *28.8.41. A convoy of 20 vehicles sent 4 M-13 combat mounts and 16 ZIS-5 vehicles for ammunition in the Smolensk direction to replace faulty M-13 mounts in Captain Comrade Flerov's battery and 450 M-13 rounds for his own battery ... "*[16] ...

In the report of the command staff of the military unit No. 4207/42 OAD / dated September 1, 1941 to the Deputy. Beginning GAUK special department art. weapons (the name of one of the signatories of the report Sinitsyn) is indicated:

"I *hereby inform you that you sent four M-13 combat mounts, one type" A "flyer, one marching charging station and fifteen ZIS-5 vehicles with ammunition for the MU-13 in the amount of 450 pieces. On the basis of your order, all the batteries of the M-13 installation in this battery for Nos. 3,4,5,6,7, total of five pieces, were handed over to your representative of the head of the column l-t . Narbekov Y.B. to accompany them in repairs. Moscow. At the same time I report that the battery of Commander Flerov by the order of the head of the arto 24 army entered into the 42 separate artillery division* ". [17].

On the night of October 7, 1941, the battery was ambushed near the village of Bogatyr in the Znamensk District (formerly Vyazemsky) of the Smolensk Region. Captain I.A. Flerov ordered to undermine the installations and died himself, preventing the enemy from seizing a new secret weapon. At the place of death and in the city of Orsha, monuments to the soldiers of the 1st experimental missile battery were erected.

On the night of July 21-22, 1941, a second battery went to the Western Front, and later others were formed. The installations were called Guards mortars, and the units in which they were in service were called Guards mortar units. Note that the formation of the first eight regiments with installations M-8 and M-13 was started in accordance with order No. 04 of August 8, 1941, the Headquarters of the Supreme High Command [17], [18].

As of August 16, 1941, one M-8 battery was formed, equipped with vehicles and 2,160 rounds of ammunition [19]. According to other sources, on August 12, 1941, the 1st division of the 5th Guards Mortar Regiment was formed and then sent to the North-Western Front, consisting of two batteries of 8 M-8 installations in each [20]. *For more information about the initial stage of the formation of Guards mortar units, see: From the history of the initial stage of the formation of Guards mortar units (M-8, M-13)* .

The date of the adoption of the installation and the M-13 projectiles is not documented. In M. Pervov's book "Stories about Russian missiles" Book one. on page 257 it is stated that "On August 30, 1941, by the Decree of the State Defense Committee, BM-13 was adopted by the Red Army." I, Gurov S.V., got acquainted with the electronic images of the GKO Resolutions of August 30, 1941 in the Russian State Archive of Social and Political History (RGASPI, Moscow) and did not find in any of them any mention of data on the adoption of the M-13 installation for service [21].

By the decree of the State Defense Committee No. GKO-303ss dated July 28, 1941 "ON THE SUPPLY OF THE MAIN ARTILLERY CONTROL OF M-8 PRODUCT. in the central warehouse and in transports 20 thousand pieces of M-8 shells. In addition, in August 1941, transfer 20 thousand pieces of M-8 shells from the Far East and Transbaikalia, obliging the NKPS to ensure their immediate transfer "[22].

M-8 shells were supplied from the Air Force from the Far East [23]. This indicates the possibility of launching 82 mm caliber aviation shells from the M-8 series combat vehicles, in other words, the unification of the ammunition and guides.

The replacement of experimental installations developed by specialists of Research Institute No. 3 for firing M-13 projectiles with the first industrial installations took place after August 28, 1941.

Work on reactive systems required a transition from mass production to mass production and the creation of a broad structure of cooperation on the territory of the country. During the war, production was carried out by enterprises in Moscow, Leningrad, Murom, Voronezh, Gorky,

Chelyabinsk, Sverdlovsk (now Yekaterinburg), Nizhny Tagil, Krasnoyarsk, Kolpino, Kolomna, Golutvin, Podolsk, Klimovsk, Lyuberets, Voskresensk, Kineshmy, Kerzhachka, Rybinsk , Yaroslavl, st. Coin, Voroshilovgrad, Stalino, Kramatorsk, Lisichansk, Ordzhonikidze, Rostov, Yeisk, Baku, Krasnodar, Tbilisi, st. Barancha, Pavlova on the Oka, Taganrog [24], [25] and, possibly, others.

It took the organization of a separate military acceptance of the guard mortar units [26].

" *The mass production of jet ammunition and their use in the Ground Forces began only during the war, ie. in the second half of 1941.*

Prior to this, production was carried out only in serial order, in small quantities, and these ammunition went exclusively to aviation armament, which is why the military acceptance of the Air Force carried out their acceptance. The need in the shortest possible time, in the context of the general mobilization of industry, to develop mass production of completely new, unfamiliar to industry, weapons, naturally created some features in the organization of production, and therefore in the organization of military acceptance at these plants.

Since the production of rockets was created anew, in the industry then there were no personnel familiar with the production of these shells (with the exception of 2 factories), the management and military missions had to take on the function of not only the controller-receiver, as a customer, but also production organizer, technologist, researcher.

Due to this, the organization of military acceptance of the UZPVS GMCh GAU (combat. No. 49 GMCh KA) had a number of features that were different from the organization of military acceptance at the UZPBA GAU.

The need for the fastest organization of mass production of hulls for rocket projectiles demanded the use of a wide cooperation of factories. The production of shells was organized as follows:

At the head of the cooperation ... the head-assembly plant, which produces, if not all the parts of the shell of the projectile, but only a part (in some cases, it does not produce anything further). The main work was assembling the shell of the projectile from parts that were supplied to him by cooperative factories. There were a significant number of cooperative factories. For example, in the Moscow cluster there were 3 assembly plants, and about 200 cooperative plants united by these plants.

The parent plant was also responsible for: a) technical management of small factories in the technology of parts production; b) providing cooperative factories with materials, tools, etc.

The military acceptance was organized accordingly ".

The head plant was the center where the leading officer of the military acceptance was located - the senior military representative, in whose subordination were the workers of the military acceptance: the military representative and art. technicians who carried out military acceptance at the factories of cooperators.

Due to the fact that there were a lot of factories, it was impossible to have an acceptance officer at each plant, so each officer was in charge of acceptance at several factories.

The direct acceptance (control) of parts was carried out by civilian workers who were available at each plant.

The territorial military acceptance was united by bushes (Moscow, Gorkovsky, Sverdlovsky, Novosibirsk, Chelyabinsk, Leningradsky, Gashensky or Galinsky (illegible, possibly Penza) Pamnentsky, Kuibyshevsky). As a rule, a district engineer was in charge of the military acceptance of the bush.

There was no cooperation at the equipment and gunpowder factories, so an independent acceptance was organized at each plant.

The supplier of shells and elements for them (gunpowder, fuses, pyro-cartridges) for the GUV GMCH KA (later UVGMCH GAU) was the People's Commissariat of Ammunition, with which a contract for the supply of ammunition was concluded at the beginning of the year "[27].

The work was carried out in difficult industrial and psychological conditions. In the report of the Deputy Chief of the Main Artillery Directorate of the Red Army, Military Engineer 1st rank Aborenkov to the Secretary of the Central Committee of the All-Union Communist Party / b / comrade Malenkov G.M. of August 24, 1941, the following information is given about this.

" Plant" Compressor "and plant them, Comintern, despite repeated requests GAU spacecraft still systematically and do not provide a fully armored M-13 and M-8 APP" om (spare parts, tools and accessories). In particular, fire extinguishers and other spare parts are not systematically donated. The absence of fire extinguishers on combat vehicles, in the absence of an armored gas tank, is absolutely unacceptable. NKOM did not and does not provide batteries with spare parts. Military representative of GAU KA on 23.8.41. refused to accept the incomplete spare parts for the cars, demanding to stop the chatter and provide both newly handed over and previously handed over spare parts.

For more than a month, the NKOM Comrade Parshin and his deputy, Comrade Kochnov, did not provide the GAU's demand for the supply of spare parts for the vehicles; employees of the office of the military representative of GAU are almost in sabotage, because of the refusal to accept incomplete machines. A similar case was at the plant. Comintern (NKOM) in Voronezh, when the secretary of the Regional Committee of the All-Union Communist Party / b / com. Nikitin accused the GAU military representative of sabotage because of his refusal to accept combat vehicles that have unacceptably gross defects.

I ask your instructions to the NKOM comrade Parshin - to stop such a system of work, since the infiltration of defective machines to serve in the Red Army in such cases may take place, because not every military representative has enough civil courage to resist such accusations "[28].

The reasons for the marriage and non-fulfillment of plans for the production of elements of rockets in 1941, established by the author, were:

Human:

- lack of the necessary contingent of engineering and technical workers and skilled workers;
- extremely irresponsible attitude of the plant management to the execution of the order;
- disorganization and inability of the plant management to use the available equipment;
- distribution of orders with delay;

Material and technical:

- lack of a tool base, cutting and measuring instruments;
- the specificity of the plant is the production of civilian products;
- remoteness of the enterprise from the location of the military acceptance representative;
- lack of the necessary equipment and the unsatisfactory condition of the available equipment;
- lack of thermal workshops in factories. The distance from the plant to the thermal workshop, in particular, at UZTM was 45 km;
- non-fulfillment by cooperative factories of the plan for details, which caused large downtime [29];

During production, at the initial stage, work was carried out to improve and simplify the production of ammunition. During the production process, a number of issues arose related to it. In particular, tasks were not always given out as clearly as possible. Thus, in a letter from the Deputy Manager of the Energotorfmash trust, Comrade Steinbock (outdated from 6/7 41g), the following was indicated: Plants of the All-Union State Machine-Building Trust Energotorfmash have begun to develop cast heads for the M-13 projectile (part 25). During the development, a number of technical questions arose. The main ones are presented below:

- whether the drawing of part no. 25 from stamping corresponds to the drawing of part no. 25 from cast steel;
- the technical specifications (TU) for the cast head did not indicate the weight of the head;
- due to what dimensions of the part can the weight be increased, since the specific gravity of stamped and cast steel is different;
- the question of the purity of the processing of the inner chamber is unclear, provided that the latter is cast without machining [30].

The changes introduced had to be coordinated with the military, who either accepted them or considered them inappropriate [31].

Similar phenomena were encountered in the production of other military products during the Great Patriotic War, as the author wrote about in his article dedicated to the 70th anniversary of the establishment of NII-147 (now JSC NPO SPLAV, Tula).

Concluding the consideration of some aspects of the production of the initial period, we note that the plan for the production of shot bodies by the NKHM and NKB factories for November 1941

the plan for the production of shot bodies by the NKHM and NKB factories for November 1941 provided for the equipment of 5,000 warheads of M-13 chemical projectiles at plant 102. The recipe for the Trolit 10 equipment from pers. / 1: 1 / [32]. Probably persil.

According to the plan for the supply of buildings by the factories of the People's Commissariat for Chemical Industry in November 1941, 6,000 d / chemical was planned. shells M-13 [33].

According to the chem. equipment for the 4th quarter of 1941 provided equipment 190,000 132 mm MX-13 - 30,000 in October, 60,000 in November, 100,000 in December [34].

In addition to the MX-13 chemical projectile [35], the MOX-13 chemical fragmentation projectile was developed [36].

For more information about the production of shells and their elements, see the galleries on our website (1 , 2 , 3 , 4 , 5).

Problems in production were in the future, which, in particular, is stated in a document dated the first half of 1943. According to this data, four M-13 installations on Gemsi vehicles (GMC) finally left the plant. Kirov in the city of Tbilisi with a delay of 1.5 months. They were not fully equipped. Contacts, pads (textolite), sights, covers and other small parts were not made at all. As a result, the units that arrived by rail were delivered understaffed to PfP No.11, in which the necessary work was performed and the units were completed. The missing alkaline batteries and mortar sights were supplied from spare parts. The Kirov Plant and the Metal Structures Plant in the city of Tbilisi initially very energetically took up the task entrusted to them,

During the war, the USSR was interested in scientific and technical information about the development of various aspects of rocket technology and jet technology in particular.

At the end of June-July 1941 in the USSR there was information sheet No. 41-38 "Jet mines used in the German army", compiled on the basis of a German trophy document - a memo dated 01.24.1941 with a description of a 28-cm high-explosive mine and a 32-cm incendiary mine mines to launch from a wooden machine. “A wooden machine is used for shooting, on which 4 mines are placed in its capping. Shooting is carried out in the area. The number of machines in one row and the number of rows are determined by the size of the area to be hit ”[38]. The first machines for firing 4 projectiles from corks installed on frames were developed in the USSR in the spring of 1942 and were improved a little later. The machine for launching 8 shells was developed in early 1943. Based on this, it can be argued that Soviet specialists began to use the German experience not after the war,

According to the document - List No. 1 of German trophy documents received by the information department of the artillery committee of the GAU KA - with an outgoing date of 08/13/1941 with the signature of BP. the head of the information department of the AK GAU spacecraft of the Military Engineer of the 1st rank Revkovsky, dated 08/12/1941, the Information Department of the Artkom GAU spacecraft possessed the following German captured documents:

1. “Description of 6 - barrel chem. mortar "D" / caliber 158.5 mm and 105 mm chemical. mortar arr. 40 and ammunition for them ”;
2. “The combat use of the battery, battalion and regiment of chem. mortars "D" / Temporary charter / ";
3. “Shooting from mortar 'D';
4. “Memo on the heavy“ wupfgerst ”40/28-cm and 32-cm rocket mines”;
5. “Times. manual on heavy "wurfegeret", installation. on an armored tractor ”;
6. “Instructions for the carriage of a heavy“ wurfgeret ”;
7. "Tables for rocket mines 28 cm and 32 cm / heavy" wurfgest "40 /".

The list of 2 German trophy documents received by the Information Department of the Artkom GAU KA mentions:

1. Album of the photo “Armament of German chemical. parts “(heavy wurfgeret 40, chemical mortar“ d ”;

2. Time. Manual for shooting their chemical. mortars "d" 1940.

In the list of information materials received in the library of the Artkom GAU KA, a document is mentioned - Technique of chemical troops of the German army and tactics of their use. Designations adopted in chemical troops for mortar ammunition “d” [39].

Based on the results of studying the German experience, a proposal arose to create and manufacture, in particular, rocket mines in the image of the German 28 cm high-explosive and 32 cm. incendiary. In a letter to the Head of the Main Directorate of Mortar Units of the Headquarters of the Supreme High Command to the Military Engineer of the 1st rank comrade Aborenko (it is not excluded that it is still Aborenkov), the acting Head of the Technical Department of the People's Commissariat of Ammunition (NKB) comrade Komarov wrote: rocket mines in the image of the German 28 cm. high-explosive and 32 cm. incendiary "(the letter was prepared on 6 / X-1941 and sent out number 1157 on 8.X.1941) [40].

The second work of the SKB of the Compressor plant was the installation of the M-8 for firing up to 36 unguided rockets M-8. The basis for the work was the order of the People's Commissariat of General Machine Building of August 2, 1941 and the terms of reference of the Main Artillery Directorate of the Red Army. Probably, this installation is referred to in the Decree of the State Defense Committee GKO-338ss of July 31, 1941 "On the production of M-8 installations in August", which obliged the People's Commissariat for General Machinery (Comrade Parshin) to produce by August 1 of this year. (inclusive) 3 batteries (18 pieces) of M-8 installations, and NKO (comrades Yakovlev and Aborenkov) to carry out field tests of M-8 installations on the same day. It also obliged the People's Commissariat for General Machinery (Comrade Parshin) and NII-3 (Comrade Kostikova) to provide for the use of RS-82 Air Force shells in the design and manufacture of M-8 installations [41].

According to the act “On the operation of M-8 machines when testing 82mm. rockets for the purpose of testing firing tables ”(printed on 08/08/1941) in the period from July 30 to August 1, 1941 on the territory of the Sofrinsky Artpoligon tests were carried out to develop firing tables on the basis of the order of Colonel-General Yakovlev. During the tests, the following number of shots was fired from the vehicle: July 30 - 5, July 31 - 78, August 1 - 80 pieces. Shooting of shells from a fully charged vehicle / 38 shells / during the test was not carried out. During the test, no failures were found in the operation of the electrical network, the fire control device and the pyro pistols. With great effort, some of the machine guides were loaded. The minimum firing angle was 15 °. At a lower angle, it was possible for shells to hit the cabins of a car.

During the test on July 30, 1941, it was found that when the first two shells of the windmill were fired (probably referring to the AM-a aviation fuse), the other shells that were in the guides were turned inside out. In order to avoid this, it was necessary to use chickenpox with welded antennae. The time required to load the vehicle with 20 shots by a fire crew of 5 people averaged 10 minutes.

The conclusion indicated that, according to the landfill, the M-8 machine for launching 82 mm shells could be adopted by the Red Army. It was necessary to improve the method of igniting the rocket charge, since charging the pyro pistols was not entirely convenient. In order to reduce the period of charging the pyro-pistols with pyro-cartridges, the test site recommended replacing the screw-in of the pyro cartridge with a dry connection [42].

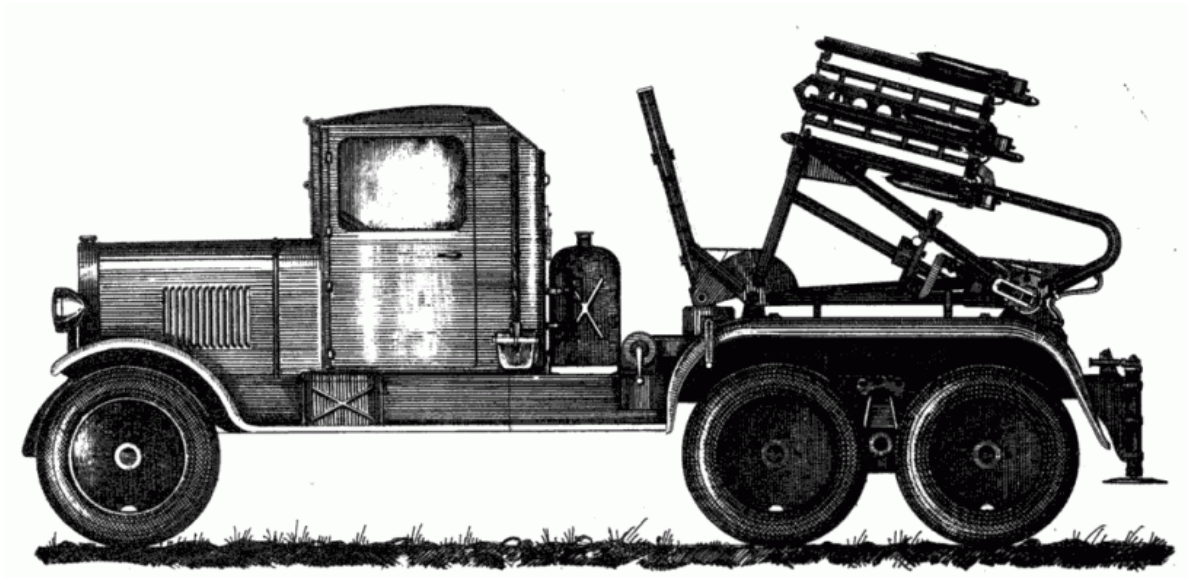
On August 2, at the Sofrinsky Artillery Range, tests were carried out “in *accordance with the order of Colonel-General Comrade YAKOVLEV”* in order to determine “the *nature of the operation of the machine loaded with a full set of 82mm.R.S. 38sn. /* "And the definition of" *density and area of destruction when firing 38 shells* . " The car was loaded with the 38th 82mm R.S. 38 shots were fired. The average point of fall in meters was 4920 m. For the projectiles, “ *AM fuses with chickenpox were used, while when winding the chickenpox onto the fuse, the antennae were soldered to the latter*”. Pyro pistols, fire control device, electrical wiring of the installation worked flawlessly [43, L.8.9]. On August 2, an act of the Sofrinsky test site of the USSR NKB No. 1231 of 08/08/1941 was drawn up on testing the M-8 machines [43, L.70]. One or more machine types are not identified.

In the version of the protocol of the technical meeting at the Compressor plant dated 08/09/1941 on the issue of placing flutes on the M-8 machine, on reducing the total number of flutes from 38 to 36 by removing the middle two flutes, which ensured the safety of the shot at minimum elevation angles, in The section “Decided” states that “the *experience of assembling the first M-8 machines showed the possibility of displacement of the screw of the vertical underneath mechanism relative to the frame with flutes, which creates the danger of touching the stabilizers of the product for the screw, consider it necessary to significantly increase the distance between the screw and the moving product. the goals of the two middle flutes of the lower row of flutes are eliminated, reducing the total number of flutes from 38 to 36 pieces.*

Keep the distance between flutes the same, i.e. 165 mm"[43, L.2.4].

This was the first work of the SKB to create a new model of missile weapons. Tests took place at the Sofrinsky test site in August 1941, after which it was put into service under the index 52-TP-391.

The document, dated 08/13/1941, provides information that at the Moscow plant “Krasnaya Presnya” of the USSR NKOM began assembling2 combat vehicles M-8, which were manufactured in accordance with the Decree of the State Defense Committee # 338ss of July 31, 1941 [42, L.71]. The exact date of the start of production is not indicated.



The launcher was mounted on a modified chassis of a ZIS-6 truck. At the same time, an option was being worked out on a modified chassis of a ZIS-5 truck, but as a result of tests, its insufficient cross-country ability was revealed, and the option was not recommended for adoption.

In the design of the throwing unit, guides of the “flute” type with a length of 860 mm were used with pyro pistols located in the breech. This guide was adopted for the M-8 installations, since they were in service with the aircraft of the Air Force of the Soviet Union and by that time had been mastered by the aviation industry, which was supposed to ensure their delivery to the manufacturers of the M-8 installations [44].

A chemical projectile MX-8 was also developed [45]. The exact development time has not been established.

In September 1941, a Soviet multiple launch rocket launcher fell into the hands of the German military. According to Special Order (1c) No. 11 signed by the 1st officer of the General Staff of the German Army dated 9/23/1941 “A salvo cannon was captured in the area of operation of the army group Nord, which fires 76m / m grenades. In addition, a salvo cannon is reported, consisting of 10-15 barrels, designed in one system. This cannon has a sled about 6 meters long, which is mounted at the rear of the truck. ” The order indicated that in the event of the capture of a salvo cannon or prisoners who testify about it, in accordance with the order of the High Command, pay special attention to a detailed clarification of the design of the cannon and shells. The manufacturer had to be identified immediately, which was of particular interest [45]. Based on the information provided, it can be concluded that the M-8 series installation was captured - probably M-8-36. In the fall of 1941, the Germans possessed data on a firing range of 2000-3000 m, only from one testimony the Germans learned about a range of 8000 m [46]. The range of the order of 2000-3000 m was also indicated in the draft brief instructions for installing the M-13 (data from the TsAMO RF. The link was not recorded by the author).*For more details see: On the capture of the Katyusha* . Looking ahead in time, we present data on the capture of guards mortars during the war according to the former secret reports of the FHO (Foreign Armies East - foreign armies of the east). From the outbreak of the war until December 2, 1942, only 23 guards mortars (Stalin Organs - foreign name) were captured, more than one in January 1943 and more than 13 in February 1943. At the beginning of July 1943 (an offensive operation on the Kursk Bulge), 57 installations were captured. In December 1943, the FHO recorded a total of 145 captured Katyushas, beginning on 22 June 1941. *See the installation diagram drawn by FHO based on the first POW readings.*We also present data on the losses of installations by the Red Army according to the FHO. Large losses were noted between July and December 1943. In June, 73 installations were destroyed, in August 163, September 114, October 45, November 24 and December 9. The total number - 428 pieces. In comparison with production data during this period of time, the loss of the Red Army rocket artillery installations amounted to about 25 percent. From January 1, 1944 to March 1945, an additional 141 installations ("Katyusha") were captured or destroyed. According to foreign data, during the war in the Soviet Union, the following number of installations ("Katyusha") were manufactured: 1941 - 980 pieces, 1942 - 3227 pieces, 1943 - about 3340, 1944 - about 2870, 1945 -

about 770 pieces [47].

In the generalized statement of the M-13 and M-8 combat vehicles release by factories as of 11/01/1941. the following data are indicated:

Plants	Name of machines	Completed for the period		
		before 09/01/1941	September 1941	October 1941
"Comintern"	M-13 on ZIS-6	178	110	39
	M-13 at STZ-5	-	-	15
Compressor	M-13 on ZIS-6	68	52	23
	M-13 at STZ-5	-	-	four
	M-8 on ZIS-6	58	107	9
	M-8 to T-40	-	-	3
Machine-building plant "Krasnaya Presnya" [48]	M-8 on ZIS-6	14	42	29
Karl Marx	M-13 on ZIS-6	-	20	-
Shevchenko	M-13 on ZIS-6	-	9	2 [49]

According to domestic non-archived data, in 1942, "the Red Army received 3237 rocket launchers." [134], [135].

According to the archival domestic post-war document - Information on the average monthly production of combat vehicles BM-13 and BM-31-12 (dated June 4, 1948) - the following number of installations was produced in 1942-1944 (*see the electronic form of the document*) [50]:

P / p #	Plant	Manufacturing of installations by years		
		1942	1943	1944
one.	"Compressor"	1026	1099	787
2.	"Uralelectroapparat" (No. 659)	525	704	382
3.	Kirovsky im. 1st of May	657	695	466
four.	them. Kolyuschenko (b. No. 701-721)	213	420	338

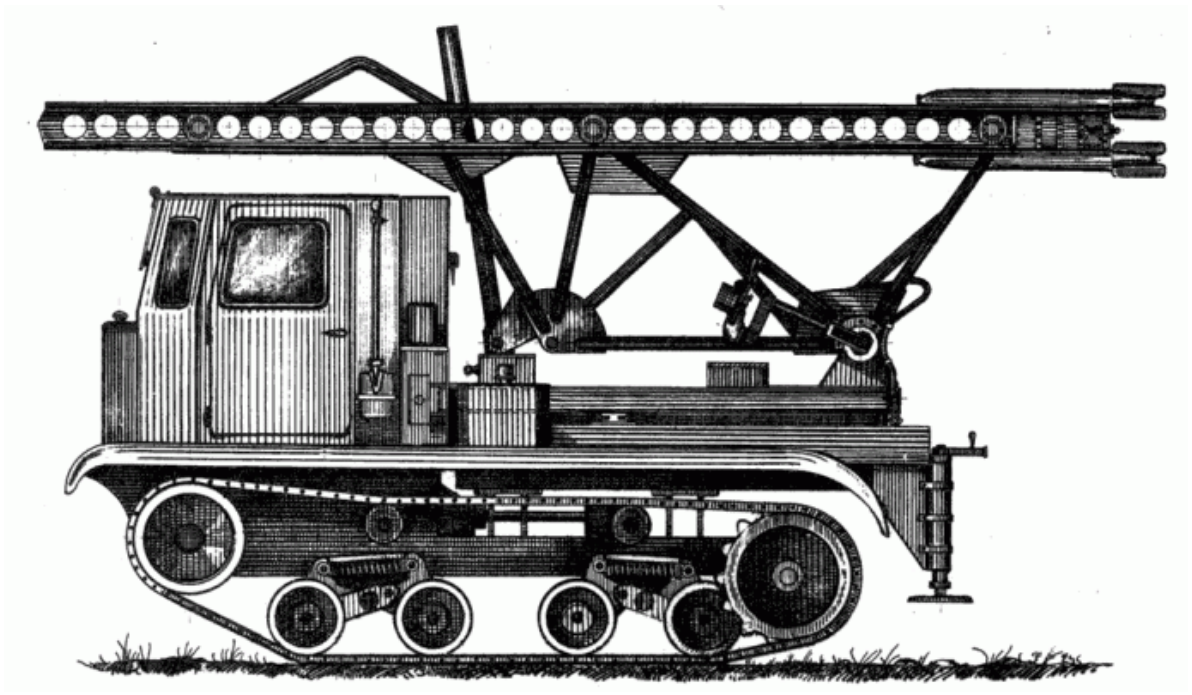
In the letter of the Deputy Chief of the General Staff of the Red Army, Chief of the Intelligence Directorate, Lieutenant General Golikov (out. No. 634380s dated September 25, 1941, Moscow) to the Chief of the Main Artillery Directorate of the Red Army, Colonel General Yakovlev, it was reported that the Germans had captured our installation for launching 42 jet shells (translated from German grenades). Here is its content: "I *am sending a photographed by the Central Radio" OSNAZ "of the Intelligence Directorate of the General Staff of the Red Army, a photogram transmitted by a Berlin radio station to New York, with an image of an automatic launcher captured from our army, throwing 42 grenades at the same time. APPENDIX: Photogram on 1 sheet* " (photogram) [51].

DURING THE WAR, THE M-13 INSTALLATION NEVERTHELESS FELL INTO THE HANDS OF THE GERMAN ARMY, AS EVIDENCED BY ONE OF THE PHOTOGRAPHS OF THAT TIME [52].

In September 1941, the installation of the M-13 was developed on the modified chassis of the T-40 light tank for launching M-13 shells. Since the chassis was overloaded, the installation was not accepted into service [53].

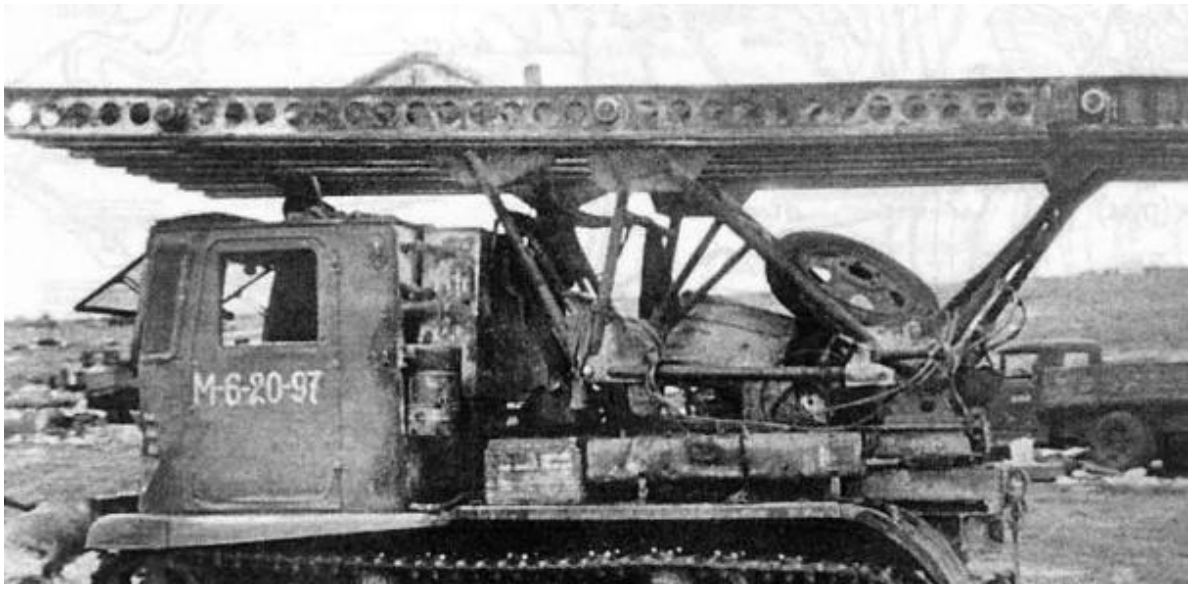
In September-October 1941, the M-13 installation was developed on the modified chassis of the STZ-5 NATI tracked tractor. Compared with the installation of the M-13 on the ZIS-6 chassis, the new version had a number of advantages: increased maneuverability on dirt roads and off-road; the possibility of direct fire due to the increase in the range of elevation angles from 0 to 45 °; introduction of a stretcher into the design of the throwing unit, which made it possible to manufacture and assemble the throwing unit regardless of the presence of a tractor chassis. The disadvantages of the installation were: low speed of movement, low power reserve and motor resource, rocking of the installation on the march.

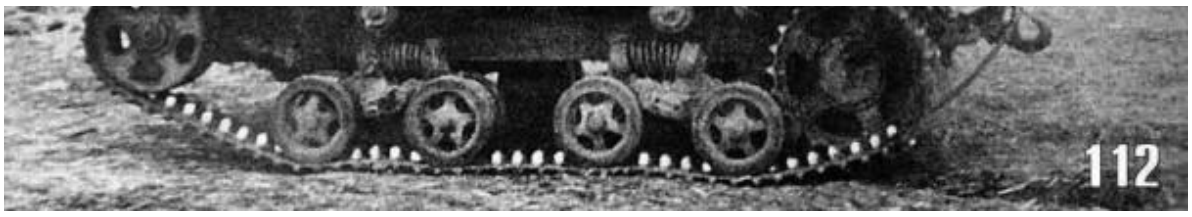
Fighting vehicle M-13 on the tractor STZ-5 was adopted by the Army under Regulation GKO № GKO-726ss on 30 September 1941, "On and armed mortar units M-8 and M-13" (1 , 2 , 3) [54]



The draft of a handwritten possible plan for the 4th quarter of 1941 planned the production of 360 installations - 120 units per month (the date indicated in the document is 9/24/41) [55]. The same data is indicated in a copy of the Order Plan of the Main Directorate of Mortar Units of the SGVK for the 4th quarter of 1941 for combat vehicles and M-8 and M-13 rounds (the dates indicated in the document are 09/18/1941 and 09/25/1941) [56]. However, as a result of combat use, it was found that the tracked propulsion unit is subject to rapid wear (on average, after passing 400-500 km), which reduced the maneuverability of the units.

In the design of the launcher, the same type of guides of the serial M-13 installation on the modified chassis of the ZIS-6 truck were used.





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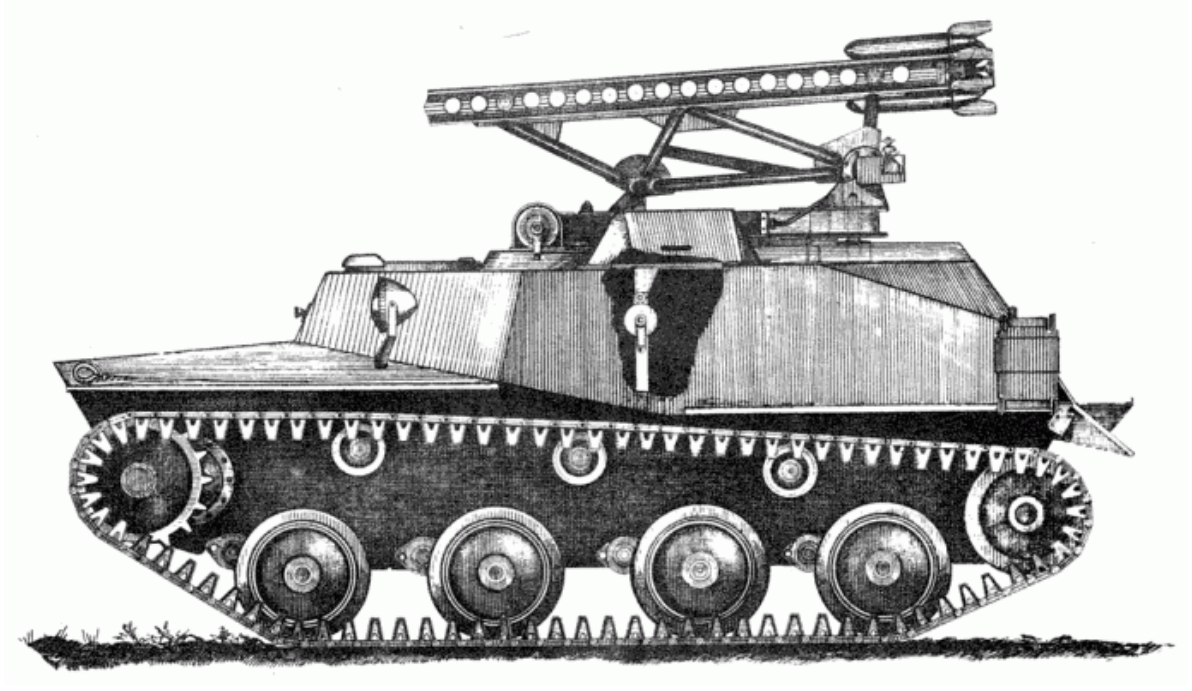
AT LEAST 2 INSTALLATIONS WERE CAPTURED BY THE SERVICEMEN OF THE GERMAN ARMY [57]. INSTALLATION OF M-13 ON A MODIFIED CHASSIS OF THE STZ-5 TRACTOR, CAPTURED BY INTACT GERMAN ARMY SERVICEMEN NEAR THE CITY OF KHARKOV (UKRAINE) IN MAY 1942 DURING OPERATION MARS

//

INSTALLATION OF M-13 ON A MODIFIED CHASSIS OF THE STZ-5 TRACTOR DURING INSPECTION BY THE GERMAN ARMY;

In September 1941, on the instructions of the GUV GMCH KA and the instructions of the NKOM, SKB specialists carried out work on the M-8 installations with a propelling unit in place of the T-40 tank turret. For the first version, a 2000 mm long “flute” guide was used. Tests have shown increased dispersion of shells. The work on the project was terminated.

On October 13, 1941, the development of a new version of the M-8-24 installation was completed for launching 24 unguided M-8 rockets of 82 mm caliber with a propellant mounted on the site of the turret of the T-40 and T-60 tanks. Based on the results of the work, it was decided to use a "beam" type guide. The installations were adopted by the Red Army and transferred for mass production to a number of factories [58]. Fighting vehicle M-8 on the T-60 was adopted by the Army under Regulation GKO № GKO-726ss of 30 September 1941, "On and armed mortar units M-8 and M-13" (1 , 2 , 3) [59]. The draft of a possible handwritten plan for the 4th quarter of 1941 planned the production of 360 units on the T-60 chassis - 120 units per month [60]. The variant on the modified chassis of the T-60 tank was captured by the German army [61], [62]. Data on the capture of the variant on the modified chassis of the T-40 tank has not been confirmed.



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DRAWING OF THE M-8-24 INSTALLATION ON THE MODIFIED CHASSIS OF THE T-40 TANK

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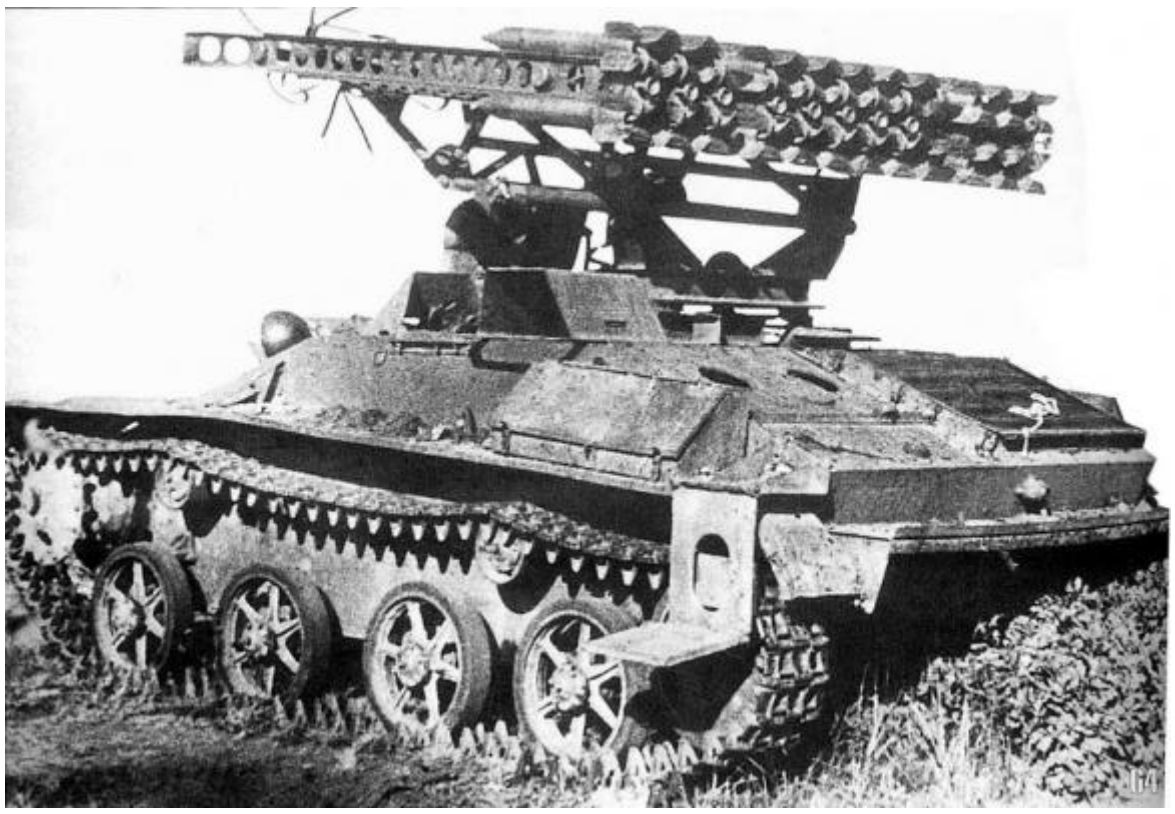
INSTALLATION OF THE M-8-24 ON THE MODIFIED CHASSIS OF THE T-40 TANK



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INSTALLATION M-8-24 ON A MODIFIED CHASSIS OF THE T-60 TANK, CAPTURED BY THE GERMAN ARMY

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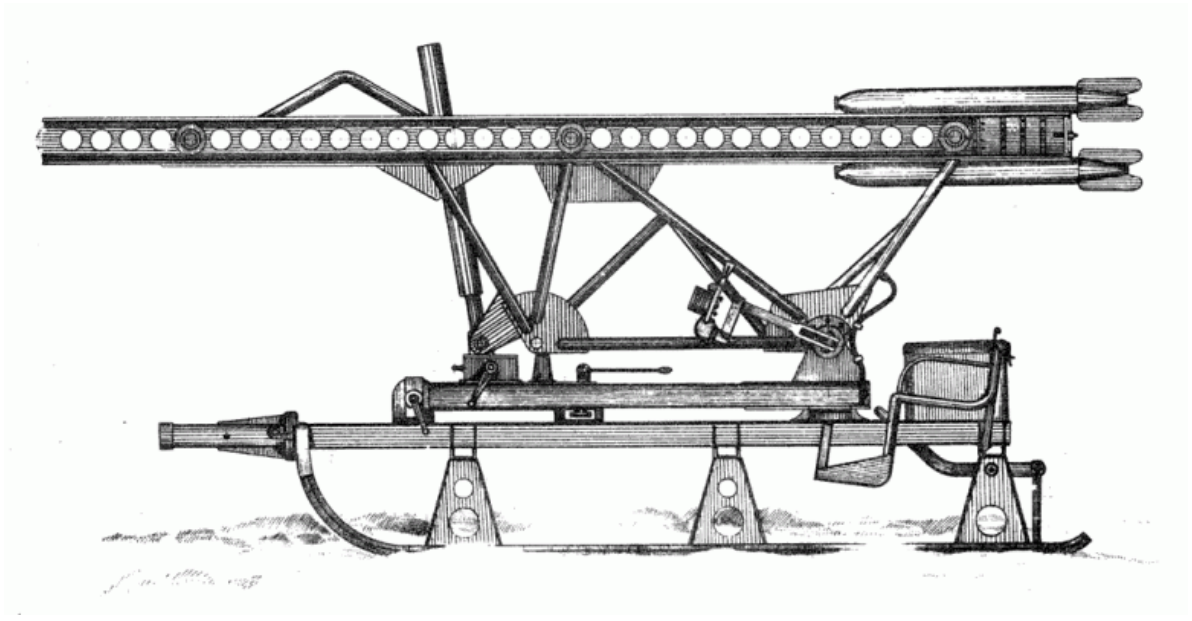
INSTALLATION OF M-8-24 ON THE MODIFIED CHASSIS OF THE T-60 TANK. GERMAN ARMY SERVICEMEN ARE CONSIDERING THE INSTALLATION

Also, work was carried out on the creation of a motorcycle installation, installation on a snowmobile, a caravan, an all-terrain vehicle, armored trains, and since 1942, sea variants (*for more details, see About the role of rocket artillery systems (MLRS) for ground forces in the world history of the development of rocket weapons in the interests of naval fleets*) for firing 132 and 82 mm projectiles.



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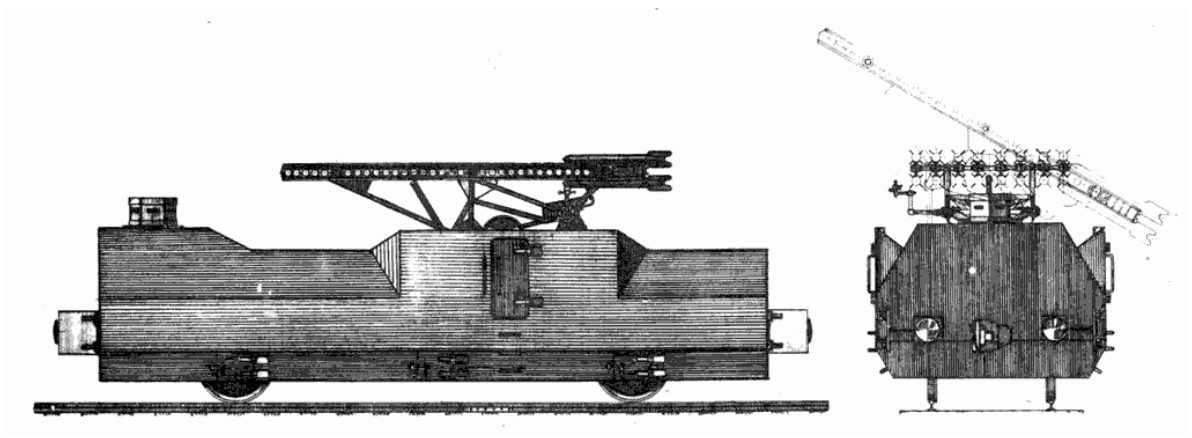
DRAWING OF M-13 INSTALLATION ON A SLEIGH

In December 1941, on the instructions of the Main Armored Directorate of the Red Army, SKB specialists for the defense of the city of Moscow developed three installations on armored railway platforms: a 16-round M13, a 48-round M8, and a 72-round M8.

The M13 launcher was a projectile launcher of the serial M-13 launcher on a modified ZIS-6 truck chassis with a modified base.



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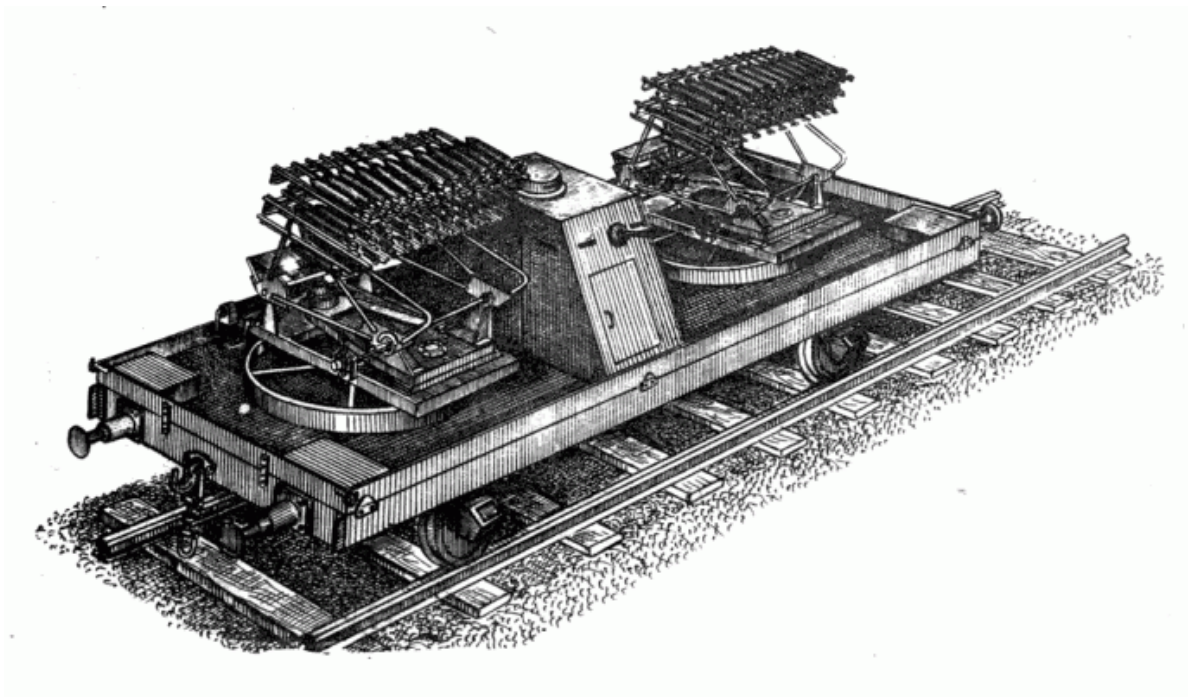
DRAWING OF THE M-13 INSTALLATION ON THE RAILWAY ARMORED PLATFORM

The M8 72-charge launcher on an armored railway platform was an M-8 launcher with flute-type guides on a modified ZIS-6 truck chassis with a modified base. The armored railway platform provided for a closed room for crew numbers and ammunition.



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DRAWING OF TWO 36-CHARGE M-8 LAUNCHERS ON A RAILWAY ARMORED PLATFORM

The 48-charge M8 was designed to be mounted on an armored railroad platform with “beam” rails. The design used two projectiles from the M-8-24 installation on the modified chassis of the T-40 (T-60) tank with a modified base in the form of a ball strap. Due to the shortage of guides of the "beam" type, the serial production of which was being established, and later due to the change in the combat situation, it was not manufactured [63].

On December 25, 1941, the State Defense Committee adopted a resolution “On the plan for the production of M-8 and M-13 projectiles for the first quarter of 1942” [64], in January 1942 - a resolution “On measures to increase the production of M-13 shells”, which outlined measures for organizing the production of charges, including at plant No. 512. In order to improve the technological processes of production of charges, a group of specialists consisting of A. Sporius, B. Pashkov, F. Khritinin, A. Galperin and others under the leadership of A. Bakaeva carried out work to create a continuous high-performance technology. For the first time in world practice, instead of periodic hydraulic presses, special screw presses were used in the production of propellants. Almost throughout the entire war period, charges for M-8 and M-13 were made from gunpowder, developed in the laboratory of A. Bakaev in the late 30s. The scarce components were replaced with more affordable ones.

As of 1942, the following propellant charges were used for the M-8 projectiles: nitroglycerin H (TC-11), pyroxylin (TC-12), nitroglycerin NM (TC34) [65].

The author discovered document TsKB-4 NKSP "Brief description of the technical design of a system of mortar installations on a railway platform", dated February 25, 1942, which indicates that extensive experience in the design of artillery systems on railway vehicles led to the idea of using reactive mortar installations on wheels and tractors for shooting from railway platforms. Comrade Mrykin, Deputy Head of the Main Directorate of Armament of Mortar Units in the city of Kazan, gave a positive assessment to this proposal. According to the project, at its core, the following tactical provisions were to be solved with the help of the system. The system was supposed to include a powerful battery, consisting of two installations M8 and M13, with the help of which it would be possible “*create massive mine fire across areas at a distance of up to 10 kilometers* . ” The system was proposed to be used either as an independent combat unit, moved “ *along the railway by a steam locomotive, a diesel locomotive, a railcar or other types of railway traction.*”. The system also had to include a shelter to protect service personnel from rifle and machine gun fire, which should also be designed to accommodate one set of mines for the M13 installation and two sets for the M8 installation. This solution coincides with the solution for the calculation and storage of ammunition with the option described above in this subsection of this subsection. The replenishment of the consumable ammunition, which was located on the system itself, would be carried out from the cellar car following the system. During the design of the system, the specialists set themselves the goal of developing all the main components of the system so that

the structure is easy to use, does not require complex equipment for their manufacture and could be manufactured in medium-sized railway workshops. The structure did not include elements of their steel casting and large forgings. Both the upper and lower shoulder straps of the bases were made from locomotive wheel rims. Both the “M13” and “M8” installations in general had the same

device. Installation data "M13" were as follows. The transition time from the stowed position to the combat position (full combat readiness) could be 10-15 minutes. The calculation was supposed to consist of six fighters. The time required for vertical guidance from 0 to 45 ° is 4.5 minutes at 45 flywheel revolutions per minute and a force not exceeding 10 kg. The min weight for the “M13” installation is 2.6 tons. Depending on the conditions of the railway gauge, the “M13” unit was designed as a 2-tier unit with 8 guides in a row, i.e. for 32 min. so the “M8” as a whole had the same device. Installation data "M13" were as follows. The transition time from the stowed position to the combat position (full combat readiness) could be 10-15 minutes. The calculation was supposed to consist of six fighters. The time required for vertical guidance from 0 to 45 ° is 4.5 minutes at 45 flywheel revolutions per minute and a force not exceeding 10 kg. The weight of the mines for the “M13” installation is 2.6 tons. Depending on the conditions of the railway gauge, the “M13” unit was designed as a 2-tier unit with 8 guides in a row, i.e. for 32 min. so the “M8” as a whole had the same device. Installation data "M13" were as follows. The transition time from the stowed position to the combat position (full combat readiness) could be 10-15 minutes. The calculation was supposed to consist of six fighters. The time required for vertical guidance from 0 to 45 ° is 4.5 minutes at 45 flywheel revolutions per minute and a force not exceeding 10 kg. The weight of the mines for the “M13” installation is 2.6 tons. Depending on the conditions of the railway gauge, the “M13” unit was designed as a 2-tier unit with 8 guides in a row, i.e. for 32 min. required for vertical guidance from 0 to 45 ° - 4.5 minutes at 45 flywheel revolutions per minute and a force not exceeding 10 kg. The weight of the mines for the “M13” installation is 2.6 tons. Depending on the conditions of the railway gauge, the “M13” unit was designed as a 2-tier unit with 8 guides in a row, i.e. for 32 min. required for vertical guidance from 0 to 45 ° - 4.5 minutes at 45 flywheel revolutions per minute and a force not exceeding 10 kg. The weight of the mines for the “M13” installation is 2.6 tons. Depending on the conditions of the railway gauge, the “M13” unit was designed as a 2-tier unit with 8 guides in a row, i.e. for 32 min.

Depending on the conditions of the railway gauge, the M8 unit was designed as a 3-tiered unit with 9 guides, i.e. for 54 min. The transition time from the stowed position to the combat position (full combat readiness) could be 10-15 minutes (the data is the same as for the M13 installation). The calculation was supposed to consist of six soldiers (the data is the same as for the M13 installation). The time required for vertical guidance from 0 to 45 ° is 2.5 minutes at 45 flywheel revolutions per minute and a force not exceeding 10 kg. The assembled M8 weight is about 2.5 tons. The weight of mines for the M8 installation is about 1.1 tons [66].

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M-8-40 INSTALLATION ON A MODIFIED ZIS TRUCK CHASSIS

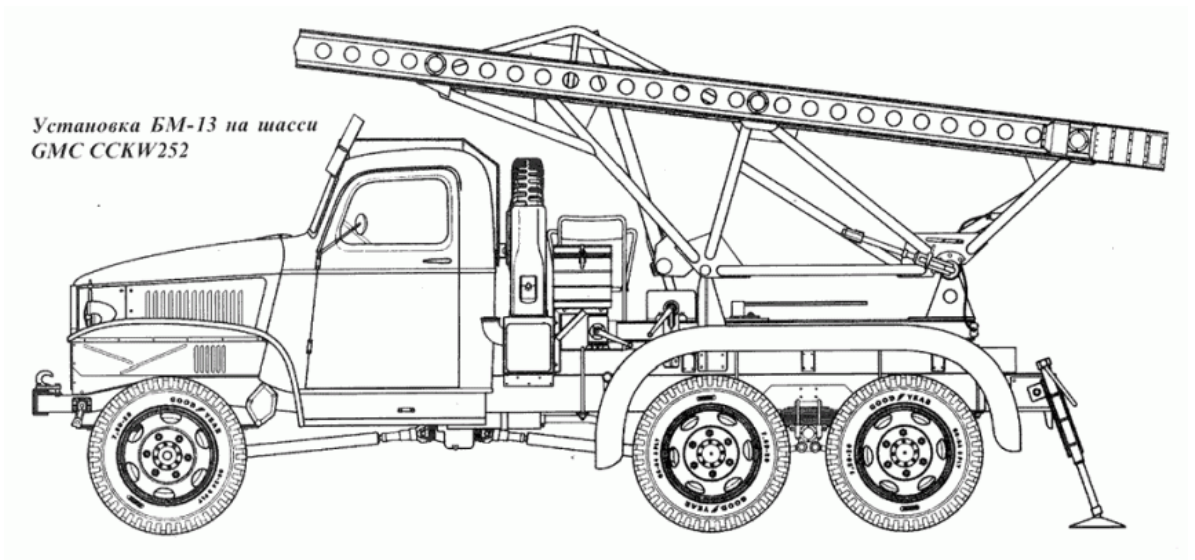
Since 1942, Soviet specialists have carried out work on the installation of projectiles, including launchers for firing 132 mm and 82 mm rockets on modified chassis of trucks received through the Lend-Lease. Among them were Dodge trucks, Chevrolet, Studebaker, Ford-Canadian, Ford-Marmon, International and several others. The most used type of chassis was the American Studebaker series. The chassis of the domestic GAZ-AA truck was also used.

It should be noted that in Russia dependence on American trucks took place not only during the Great Patriotic War, but also during the First World War. So the total number of trucks available on August 1, 1916 at the disposal of the automotive subdivision was as follows: with a carrying capacity of 5 tons - 28 pieces, 3 tons - 60 pieces; 2 tons - 92 pcs; 1½ - 95 pcs [67].

M-13 UNITS ON A MODIFIED INTERNATIONAL TRUCK CHASSIS

M-13 UNITS ON MODIFIED TRUCK CHASSIS OF THE FORD-MARMON SERIES

INSTALLATION OF M-13 ON A MODIFIED CHASSIS OF A GMC SERIES TRUCK

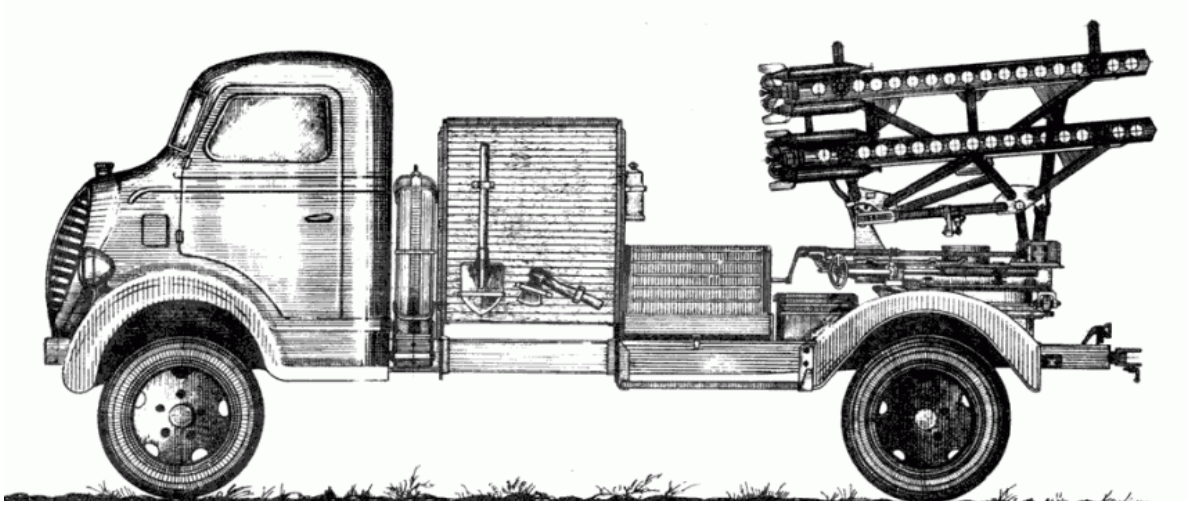


DRAWING OF THE M-13 INSTALLATION ON THE MODIFIED CHASSIS OF THE GMC CCKW252 TRUCK

INSTALLATION OF M-13 ON A MODIFIED CHASSIS OF A CHEVROLET SERIES TRUCK

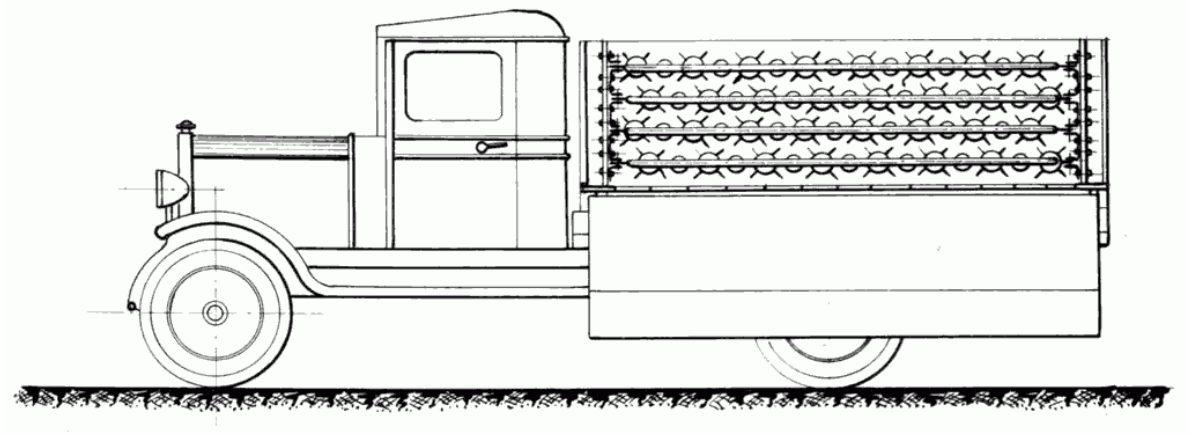
INSTALLATION OF M-13 ON A MODIFIED CHASSIS OF A CHEVROLET SERIES TRUCK

In April-June 1942, the M-8-48 unit with a propelling unit on a modified Ford-Marmon truck chassis was developed. She became the main installation for the launch of rockets M-8 until the end of the Great Patriotic War. Later, modified chassis of GAZ-AA, ZIS-6 and Studebaker trucks were also used for the installation of the projectile.



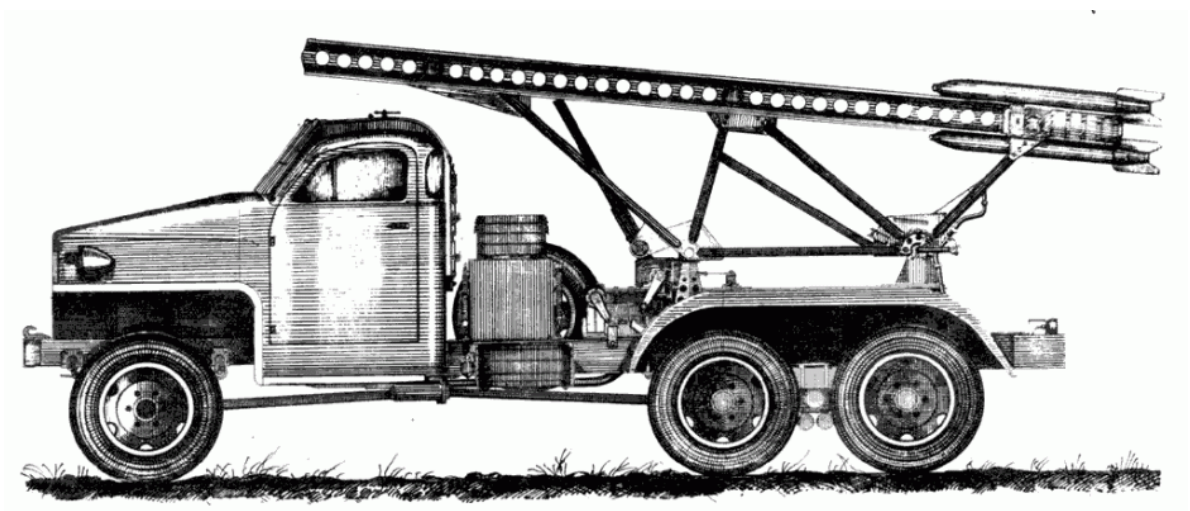
DRAWING OF THE M-8-48 INSTALLATION ON A MODIFIED FORD-MARMON TRUCK CHASSIS

In March-April 1942, a charging box on a modified chassis of a ZIS-5 truck was developed and adopted by the Red Army to transport 60 M-13 rockets of 132 mm caliber. In the back of a conventional transport vehicle ZIS-5, it was possible to transport 46 shells. The assignment was issued by the Main Armament Directorate of the Guards Mortar Units. According to modern terminology, it was a transport vehicle.



CHARGING BOX ON THE MODIFIED CHASSIS OF THE ZIS-5 TRUCK

On April 21, 1942, it was decided to develop a normalized installation for firing 132 mm projectiles. At the beginning of 1943, the work was completed with the possibility of mounting a projectile installation on various types of modified chassis.



DRAWING OF THE M-13N INSTALLATION FOR FIRING 132 MM PROJECTILES

Normalized installations have several advantages over previous releases:

- an increase in the shelling sector by 20%;
- reduction of efforts on the handles of guidance mechanisms (lifting and turning mechanisms) by one and a half to two times;
- doubling the vertical guidance speed;
- increasing the survivability of the installation due to the rear wall of the gas tank cabin and the gas line;
- increasing the stability of the installation in the stowed position by introducing a support bracket to disperse the load on the side members of the vehicle;
- increasing the operational reliability of the unit (simplification of the support beam, rear axle, etc.);
- significant reduction in the volume of welding, machining, elimination of bending of truss rods;
- reducing the weight of the installation by 250 kg, despite the introduction of armor on the rear

wall of the cabin (to protect the calculation from being hit by fragments of the rocket chamber in the event of a rupture on the rail) and the gas tank;

- reduction of production time for the manufacture of the installation by assembling the throwing installation separately from the chassis of the vehicle and mounting the installation on the chassis of the vehicle using fastening clamps, which made it possible to eliminate the drilling of holes in the side members;
- several times reduction of the idle time of vehicles arriving at the plant for installation of the installation;
- reduction of the number of standard sizes of fasteners from 206 to 96, as well as the number of names of parts: in the swing frame from 56 to 29, in the truss from 43 to 29, in the base frame from 15 to 4, etc.

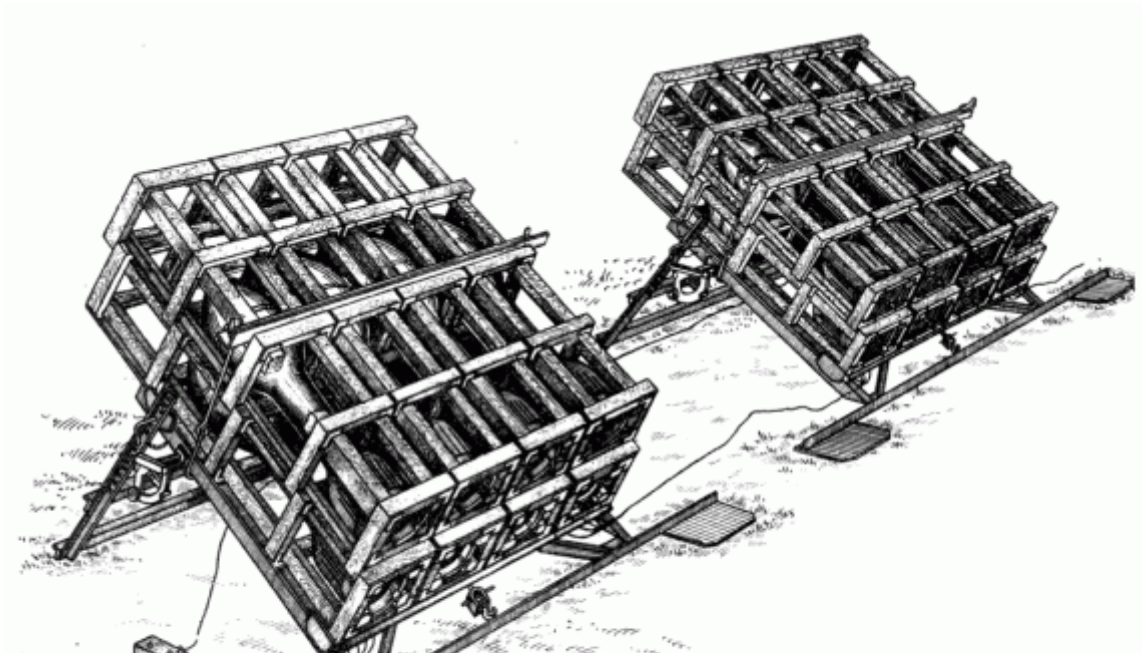
The installation was put into service and since 1943 has been the main type of installation for firing 132 mm rocket projectiles [68].

In May 1942, a group of officers from the Main Armaments Directorate developed a 300 mm M-30 unguided missile with a maximum tabular flight range of 2800 m.A powerful over-caliber warhead was attached to the rocket engine from an M-13 132 mm unguided missile. ellipsoid with a maximum diameter of 300 mm.

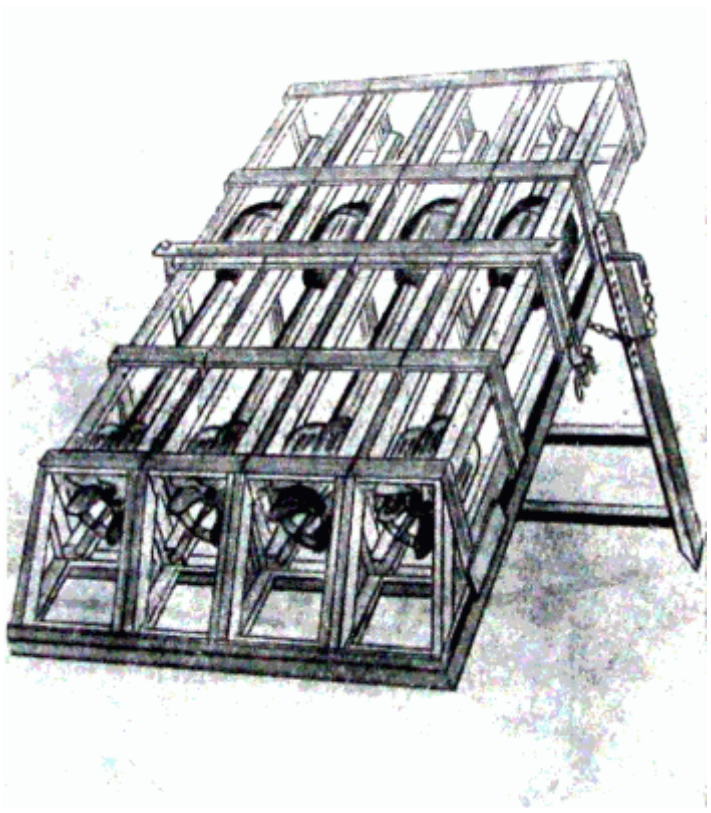
The certificate on the technical data of the 303 mm M-30 BM missile, signed by the Chief of the GUVGMCH SVGK KA, Colonel Kuznetsov, Engineer-Colonel Kuznetsov on May 31, 1942, contains the following projectile data: the weight of the finally equipped projectile - 82 kg; the volume of the chamber for explosives or substances is 19.7 liters, the range is 2550 m. The note indicates that the missile part was taken from the existing M-13 projectile [69, L. 106].

In a letter from Aborenkov to Malenkov dated June 1, 1942, it is indicated that the tests of the first samples showed that the projectile has exceptional power, scarce TNT is not required due to equipment with non-deficient nitrol (liquid explosive is a mixture of nitrobenzene and nitrogen oxides). When the projectile burst, a funnel with a diameter of 7 meters and a depth of 2.5 m was formed. According to the test results, it was found that the M-30 projectile could immediately be accepted for bulk production. In his letter, Aborenkov asked for the M-30 projectile to be adopted by the guards mortar units and technical brigades. The use of M-30 shells in guards mortar units was most expediently used by including the fourth M-30 divisions in the regiments. In the technical brigades, it was necessary to form the fourth battalions M-30 [69, L. 107,108]. The M-30 high-explosive heavy rocket was adopted by the Red Army by DecreeGOKO-1867ss dated June 4, 1942 "On the adoption of the Red Army and the production of M-30 shells" [70]. A significant drawback of the M-30 projectile was its short flight range. This drawback was partially eliminated at the end of 1942, when a new unguided missile M-31 with a high-explosive warhead with a maximum flight range of 4325 m was created. The MX-30 rocket with a chemical warhead was also developed [71].

In May 1942, the SKB at the Compressor plant began work on the creation of a machine for launching unguided rockets M-30 (MZO index, called “box 30”, box M-30 or throwing device “M-30” [72]) ... To transport frames and M-30 ammunition, sledges were developed [73] (probably for winter conditions). Stationary machine tools were initially developed, followed by mobile launchers. The projectile manufactured at the plant was transported to the launch position in the capping, from which it was launched. To carry out the launch, on the inner surface of the cork, there were longitudinal wooden bars upholstered with metal strips, along which the shells slid during launch. From the end, it had a removable bottom, which ensured the exit of the projectile when firing. Sometimes the shells were launched with capping.



DRAWING OF A MACHINE FOR FIRING PROJECTILES M-30 FROM CAPPING



THROWING DEVICE M-30

Note that for firing mines DM-2 and DM-1, the entire materiel of the divisions used for mines M-31 and M-30 could be fully used without any alterations, except for a minor alteration of the M-30 box [74].

In June 1942, along with the M-30 projectiles, 132 mm M-20 projectiles entered service. However, according to the Resolution of the State Defense Committee GKOK No. 2135ss of August 4, 1942 "On the production of M-20 and M-30 shells in August and September 1942" (1 , 2 , 3) accepted the proposal of the Main Directorate of Armament of the Guards Mortar Units (Comrade Kuznetsov) and the Institute of Rocket Engineering (Comrade Kostikov) to adopt the M-20 rocket projectile [75]. It was intended for firing with the M-13 combat mounts, but only from the top row of guides - 8 pieces. In order to increase the density of fire during salvo firing with M-20 rockets of 132 mm caliber, a special device was developed for launching them using M-30 frames. Six M-20 shells were stored on each M-30 frame. A document dated September 9, 1942 mentions special instructions for the use of M-20 guides on M-30 machine tools for firing M-20 projectiles. To use the M-30 frame for launching M-20 projectiles, special M-20 guides should be installed on the frame. For this, in turn, it was necessary to make cuts in the lower square and the upper transverse square. It was possible to make the slots with a flat file, and such work had to be done by the forces themselves [76]. Thanks to this solution, the density of fire of the M-20 projectiles more than quadrupled. Due to the low efficiency of the high-explosive action of the warhead, the fulfillment of combat missions for the destruction of defensive structures was not ensured. Also, due to the insignificant fragmentation effect, the shells did not give the desired effect when firing at manpower. Therefore, the M-20 projectile was not widely used and was removed from service in 1943. In 1944 and 1945, the troops spent the remaining stocks of M-20 shells [77]. It was possible to make the slots with a flat file, and such work had to be done by the forces themselves [76]. Thanks to this solution, the density of fire of the M-20 projectiles more than quadrupled. Due to the low efficiency of the high-explosive action of the warhead, the fulfillment of combat missions for the destruction of defensive structures was not ensured. Also, due to the insignificant fragmentation effect, the shells did not give the desired effect when firing at manpower. Therefore, the M-20 projectile was not widely used and was removed from service in 1943. In 1944 and 1945, the troops spent the remaining stocks of M-20 shells [77]. The cuts could be made using a flat file, and such work had to be done by the forces themselves [76]. Thanks to this solution, the density of fire of M-20 shells has more than quadrupled. Due to the low efficiency of the high-explosive action

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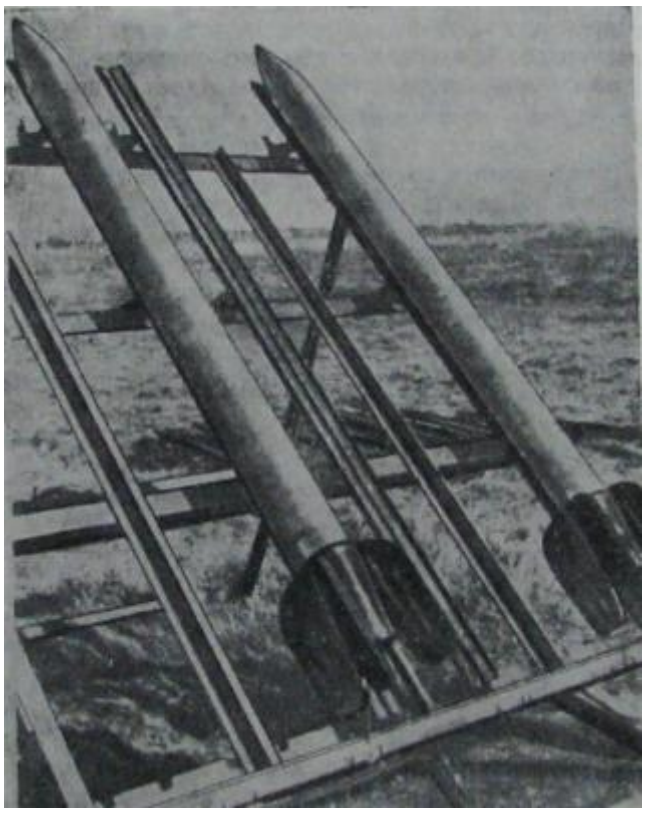

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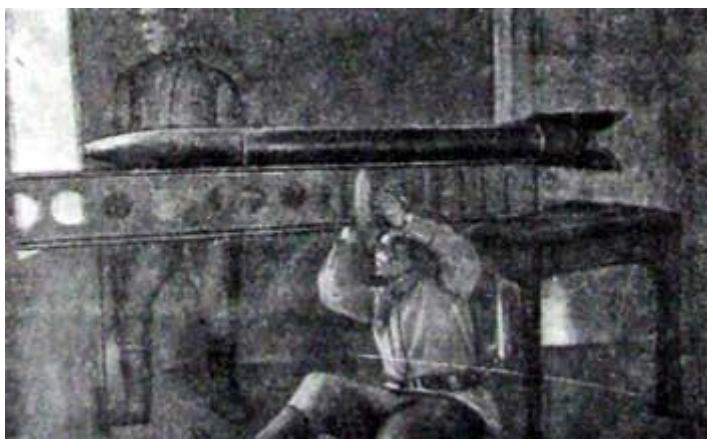
MACHINE FOR LAUNCHING UP TO 6 PROJECTILES M-20 BASED ON THE FRAME M-30



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HOMEMADE INSTALLATION FOR LAUNCHING A PROJECTILE M-20

The project for an extended-range 132 mm unguided rocket was developed in 1942. The work was carried out at NII-1 NKAP (tests of the M-13-DD missile, according to 1944 data [78]). It was the first NURS with a two-chamber rocket engine. Both chambers were standard NURS M-13 chambers and were connected by an intermediate nozzle including eight oblique nozzles. The rocket engines were running simultaneously. For the projectile, the head of the 132 mm M-13 unguided rocket was used. The projectile, designated M-13DD, underwent field tests in the Urals, after which it was modified. On March 15 and 16, 1943, repeated field tests were carried out at the proving ground near Moscow.1 , 2 , 3) [79].

In late August - early September 1942, the USSR began work on mining installations. Initially, two options for installations were proposed: one on the machine (on the gantry), and the other on a two-wheeled cart. For both options, the use of guides from the M-8-36 installation was provided.

The installations had the following disadvantages: further simplification of their design and technology was required, there was a difficulty in developing aiming and horizontal guidance nodes. As a result of the work carried out, the option on the machine was chosen.

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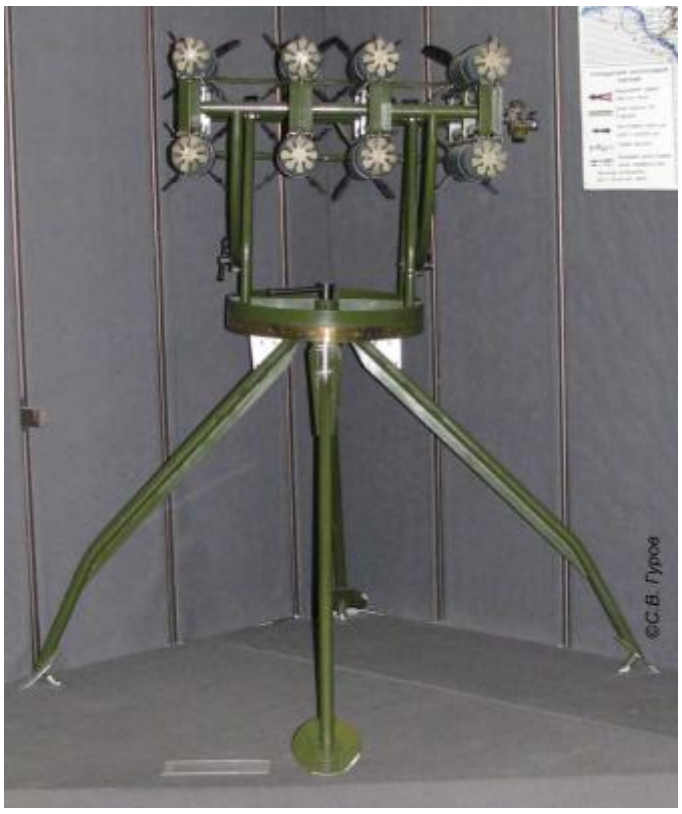
MINING RIG MODEL. FROM THE COLLECTION OF THE CENTRAL MUSEUM OF THE ARMED FORCES (MOSCOW) © S.V. GUROV



After the development of the first sample, its further improvement was entrusted to the specialists of the SKB of the Compressor plant. The installation was disassembled into three main parts. Tests for strength, safety and serviceability were carried out from 12 to 26 July 1943, and it was recommended for adoption.

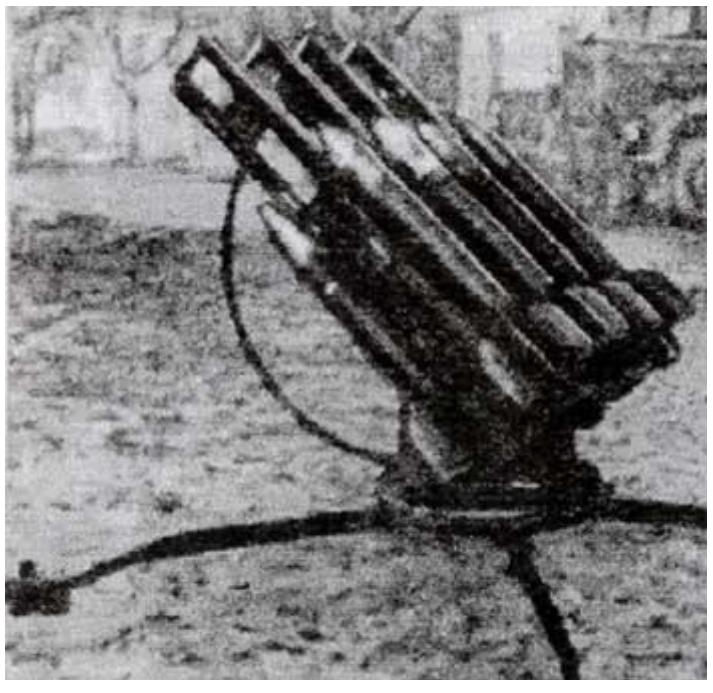
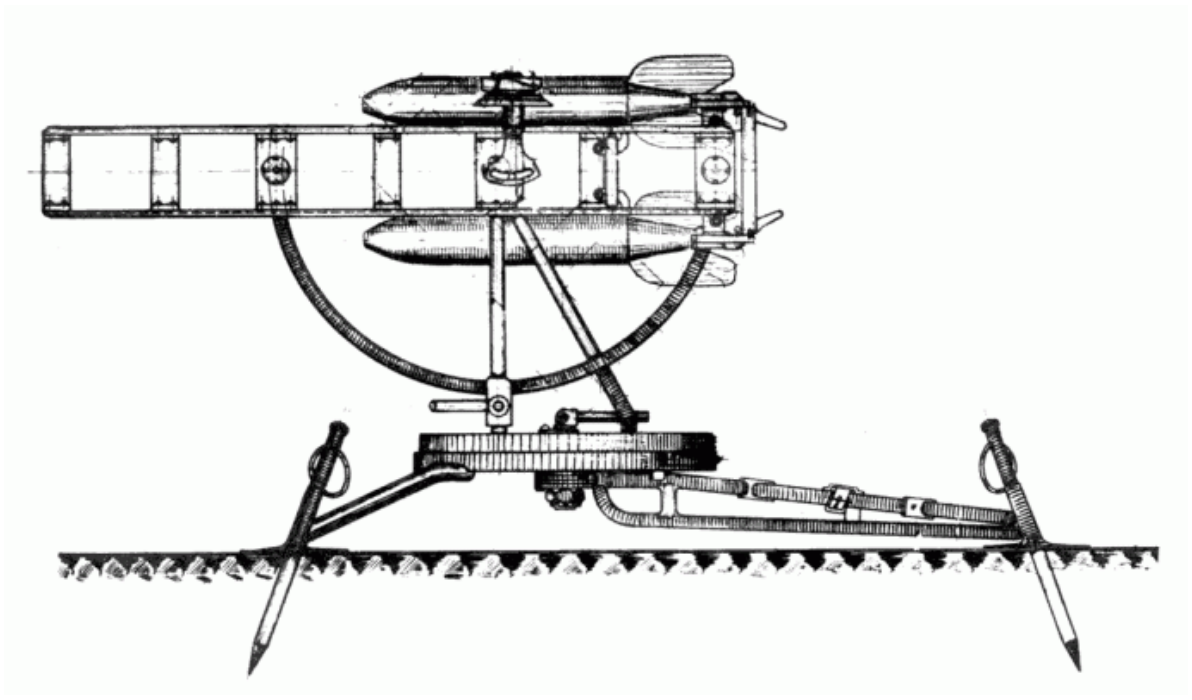


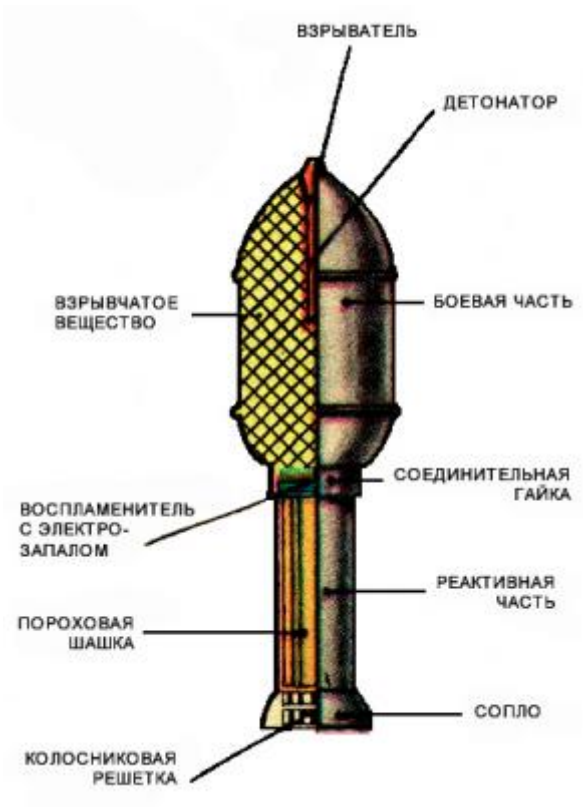
FIGURE 8-CHARGE MINING (MINING) INSTALLATION M8 OF THE SECOND SAMPLE



MINING RIG OF THE SECOND SAMPLE

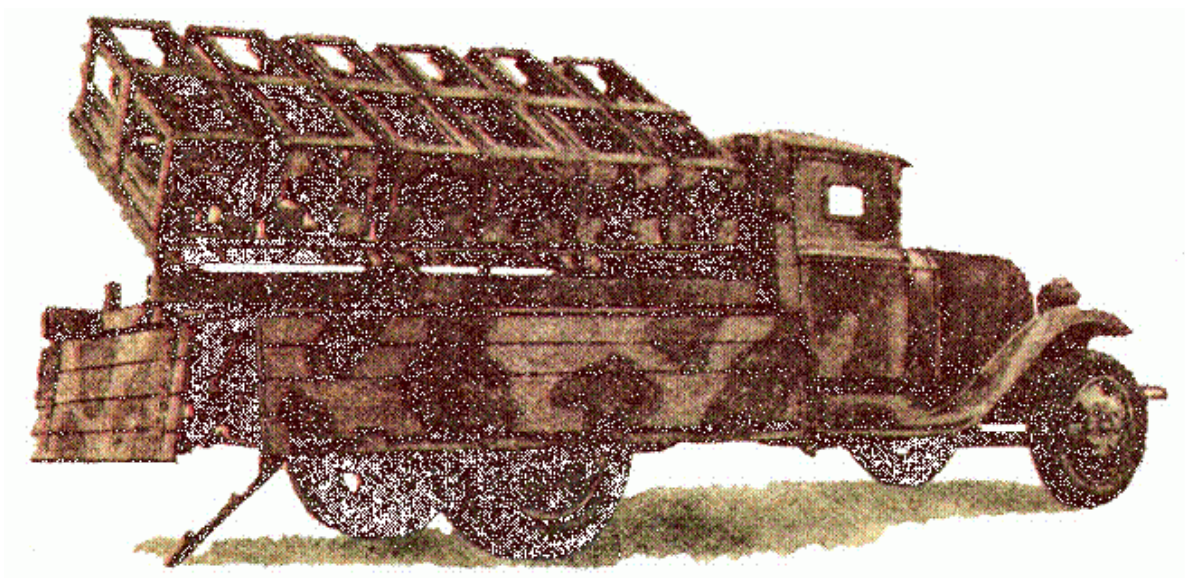
The mountain Katyushas produced in the seaside city of Sochi were then used by the Red Army in the Crimea, Carpathians, Tatras, in the mountains of Korea and China ”[80].

From 1942 to 1943 in Leningrad, during the blockade, on the basis of German turbojet mines, an M-28 turbojet mine of 280 mm caliber with a high-explosive warhead and several types of machine tools were developed. The shell was developed by a group of designers from the Leningrad Research Artillery Institute under the leadership of General S.M. Serebryakov [81].



DRAWING OF A TURBOJET MINE M-28

In the early autumn of 1942, the LAP-7 six-shooter was also manufactured in Leningrad (Leningrad Artillery Range, seventh). The launcher was mounted on a modified chassis of a GAZ-AA truck. It was intended to launch projectiles from the capping. The tests carried out showed that the installation meets the basic requirements of rocket weapons. She was recommended for adoption [82].



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INSTALLATION OF LAP-7 ON A MODIFIED CHASSIS OF A GAZ-AA TRUCK

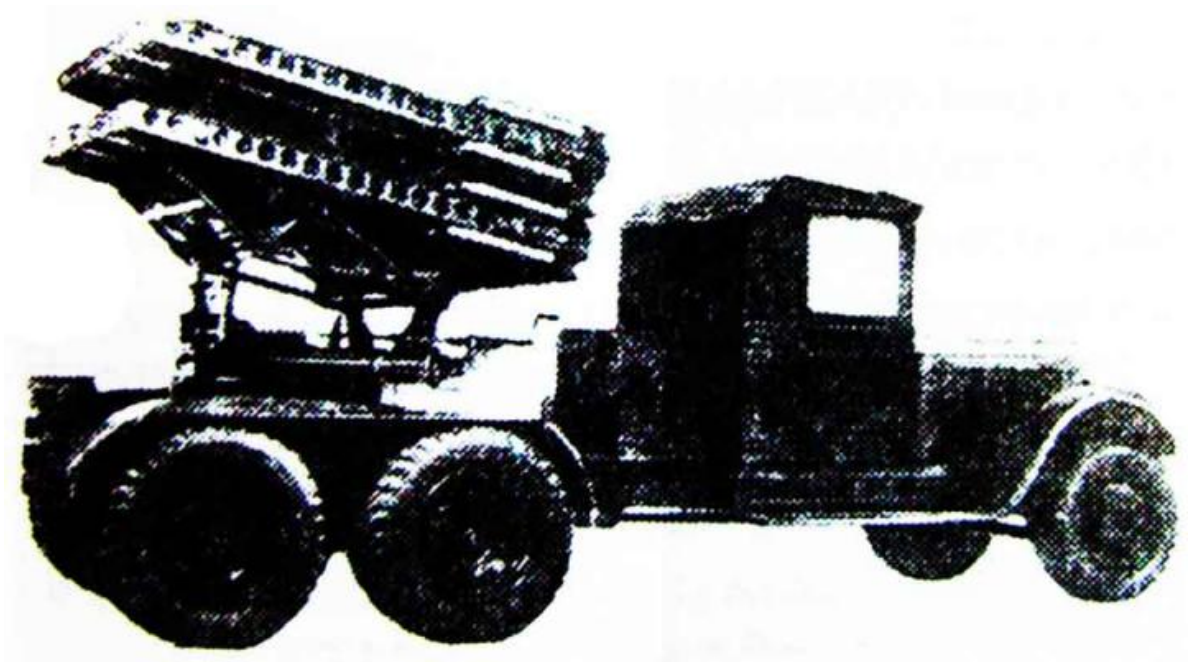
Approximately the period 11.11.1942 to 31.12.1943 includes work on the manufacture and testing of imported nitroglycerin powder GCD [83].

By the first half of 1943, the decision can be attributed to the adoption of rocket charges for missile parts of M-13 projectiles from NM-4Sh screw powder for mass production [84].

In 1943, work was carried out by specialists from the Special Experimental Production Bureau of the NKB and the Leningrad test site to study the chemical resistance of ammonals; fragmentation test of 132 mm high-explosive fragmentation projectiles M-13 and detonation of M-28 mines. Experts from NII-3 and the Sofrinsky test site were engaged in bench tests of charges made up of 5 N-31 and 6 / 8-900 checkers, tests of M-13 projectiles with reactive charges made of NP-22 propellants, conducted bench tests of NOD-4 charges and others. questions [85]. The issues of storage and transportation of chemical projectiles, their coloring and marking [86], rationalization proposals and drawings of devices for inserting pyro cartridges into products M-13, M-20 [87],six-barreled mortar (1.3.43 - 18.4.43) [90].

At least in the second half of the summer of 1944, some captured six-barreled mortars were used by soldiers of the Red Army in hostilities against the Nazi troops [136], [137], [138].

In November 1943, the M-8-48 installation was developed on a modified ZIS-6 truck chassis. All the main structural units were unified with the units of serial installations: a package of guides from the M-8-48 unit, and a swing frame, lifting and slewing guidance mechanisms and a junction box with the corresponding units of the M-8-36 unit.



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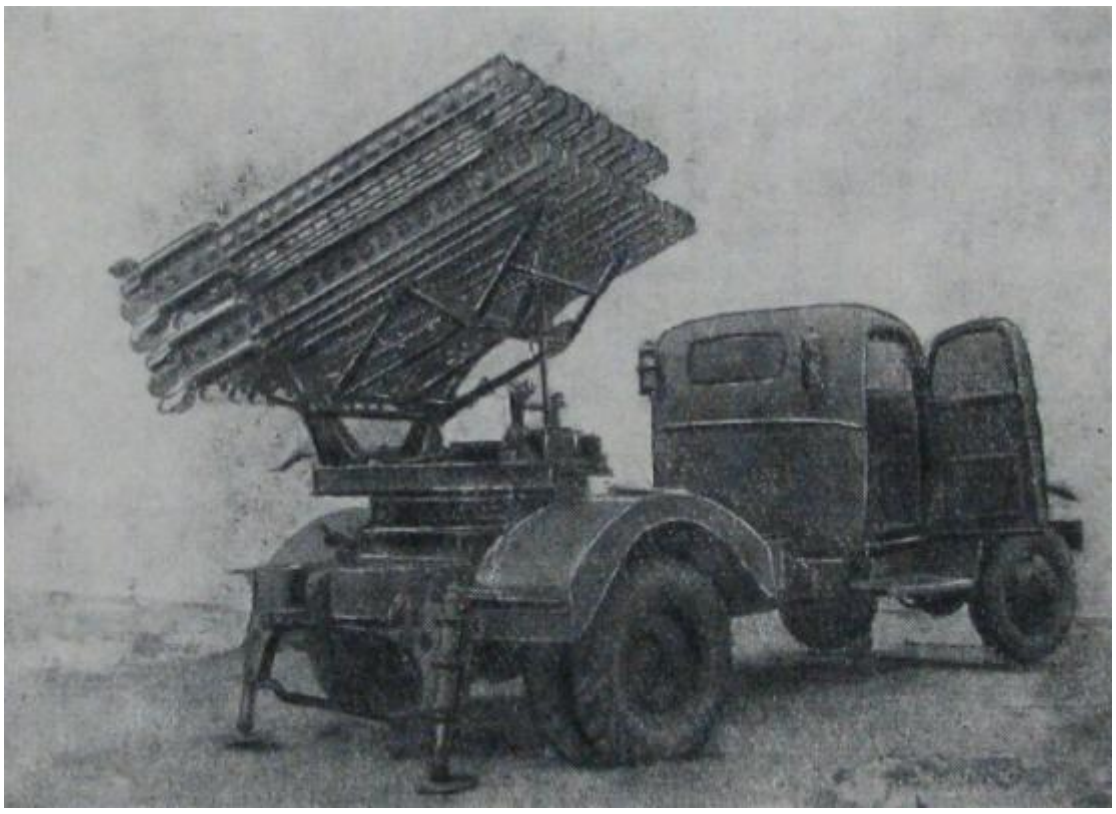
INSTALLATION OF M-8-48 ON A MODIFIED CHASSIS OF A ZIS-6 TRUCK



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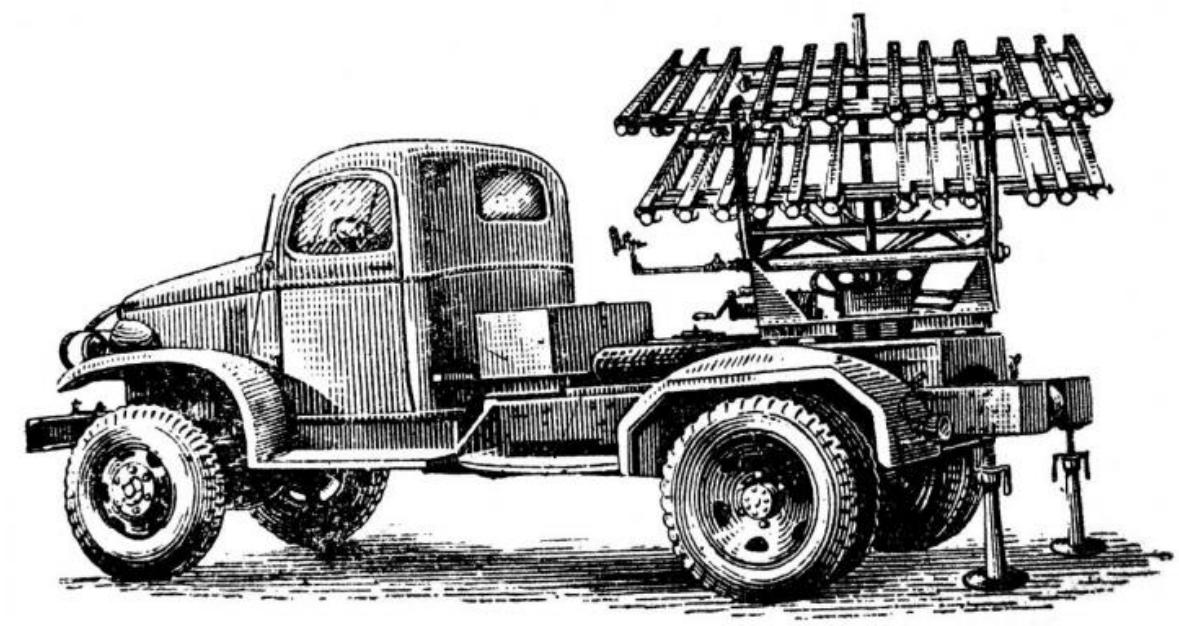
INSTALLATION OF M-8-48 ON A MODIFIED CHASSIS OF A FOREIGN TRUCK (PROBABLY CHEVROLET - CHEVROLET)



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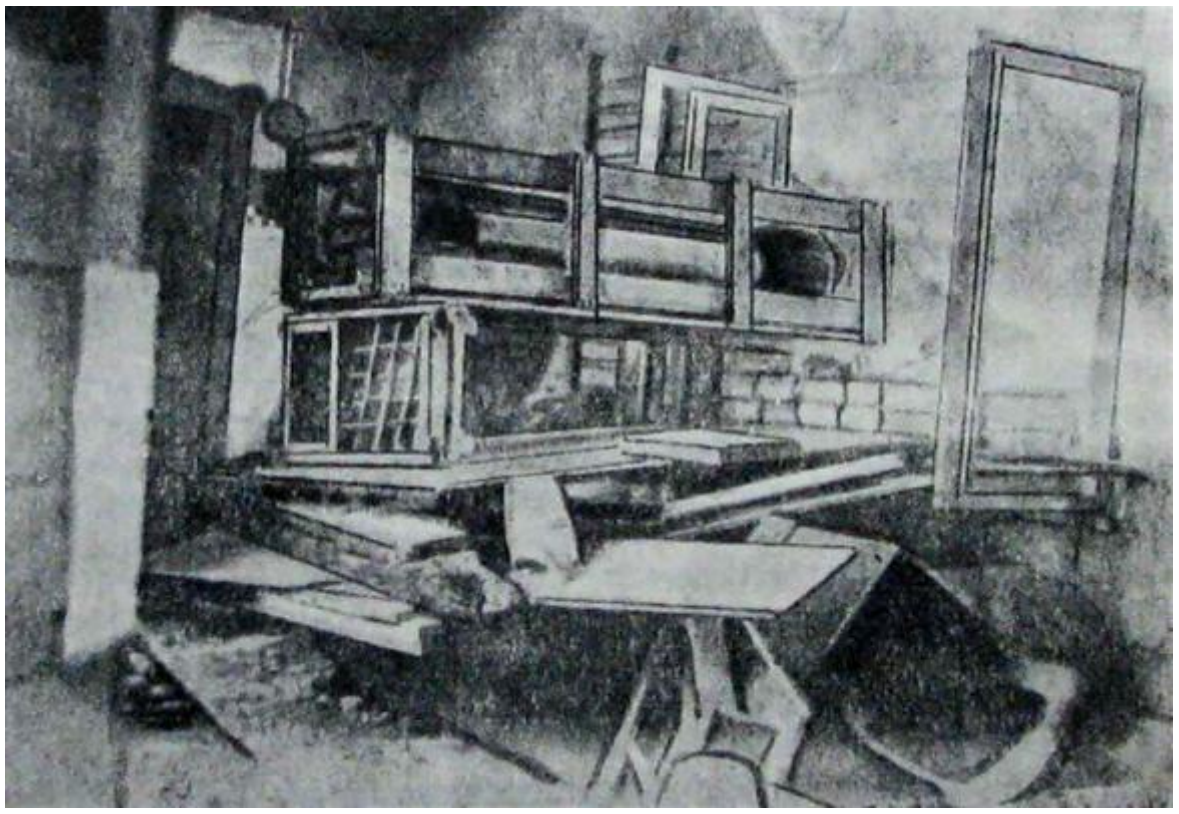
INSTALLATION OF M-8-48 ON THE MODIFIED CHASSIS OF A CHEVROLET TRUCK (CHEVROLET)

In December 1943, SKB specialists developed a frame installation - “M31 machine”. It was intended for firing M-31 rockets. The corks with shells were placed on the machine frame in two tiers and secured with removable ties. The front support of the machine base was floating on two runners, the rear one was fixed with bipods cutting into the ground. The installation was used in all offensive operations of the Red Army when breaking through the enemy's defense [91].



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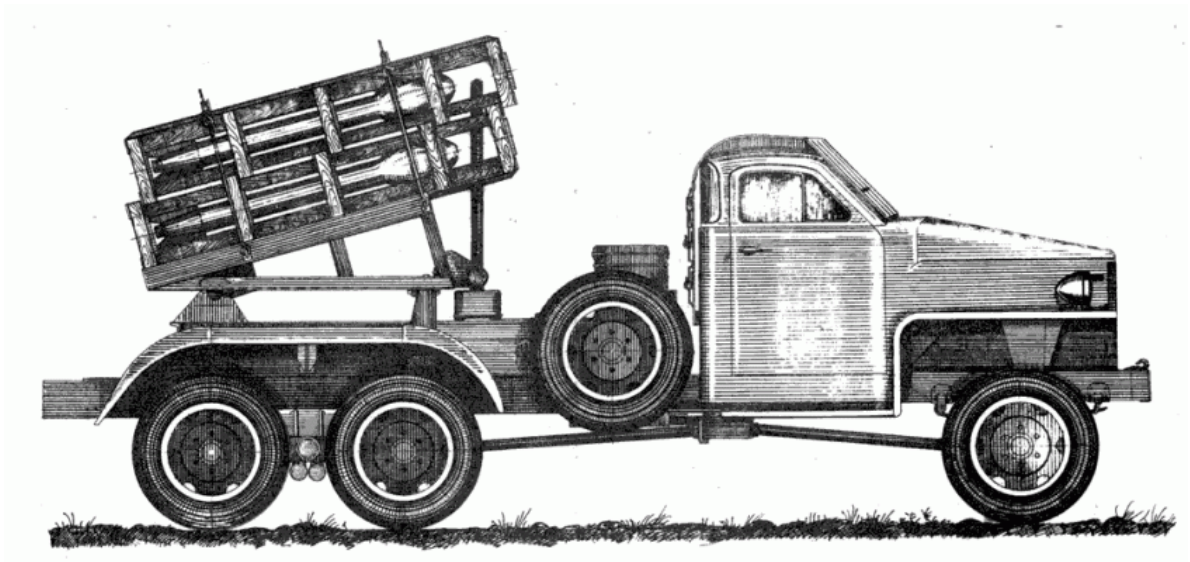
CAPPER WITH M-31 PROJECTILE FOR DIRECT FIRE

An MX-31 rocket with a chemical warhead was also developed for firing [92].

In 1944, reports and acts of the Sofrinsky test site and research institutes No. 1 and No. 6 on testing imported gunpowders [93] were drawn up, a report from the Sofrinsky artillery range on improving the accuracy of rockets [94], temporary technical conditions were issued for stamping and acceptance of stamped blanks for the M-8 projectile head [95], test sites and factories reported on the implementation of experimental work to improve the accuracy of rockets [96], the specifications of the control and measuring tool for the RS M-8, M-13, M-31 products [97], the report of ANIOP GAU KA on the study of mines was prepared, the work of the Leningrad State University on the accuracy of a rotating rocket feathered projectile (4.01.44 - 10.04.44) [98], a report by the GAU GAU KA on the determination of the maximum speeds of missiles [99], a report by the GAU GAU KA about studying the reasonscausing dispersion of missile projectiles [100], NII-6 report on the study of a 150 mm German incendiary projectile [101].

On February 15, 1944, the GUV GMCH KA issued the SKB at the Moscow plant "Compressor" TTT for the development of a mobile installation for firing M-31 projectiles. The prototype was developed in February-March 1944. The BM-31 12-charge setup was based on the Studebaker off-road truck chassis. In the design of the launcher, units and parts of the normalized installation M-13N were used, except for the guides and the truss. M-31 projectile corkers were used as guides, which were placed on a special farm. After successful field and sea trials, the installation was adopted by the Red Army. Later, it was replaced by a more advanced BM-31-12 installation with honeycomb rails on a modified Studebaker truck chassis, developed in February-March 1944 at the initiative of the chief designer V.P. Barmin. With the exception of the monoblock guides and electrical equipment, the rest of the installation units were unified with the units of the normalized combat installation M-13N. The tests, in particular, were carried out at the Sofrinsky test site [102]. By the Resolution of the GKONo. 6029ss of June 9, 1944 "On the adoption of the M-31 combat installations for the Red Army and the rearmament of 12 M-31 divisions", the M-31 twelve-shot installation of the Barmin design, mounted on a chassis for firing M-31 projectiles with improved accuracy. The decree also established a plan for the production of M-31 combat units for the 2nd quarter of 1944 in the amount of 250 units. The appendix to the decree indicates its brand - BM-31-12 [103].



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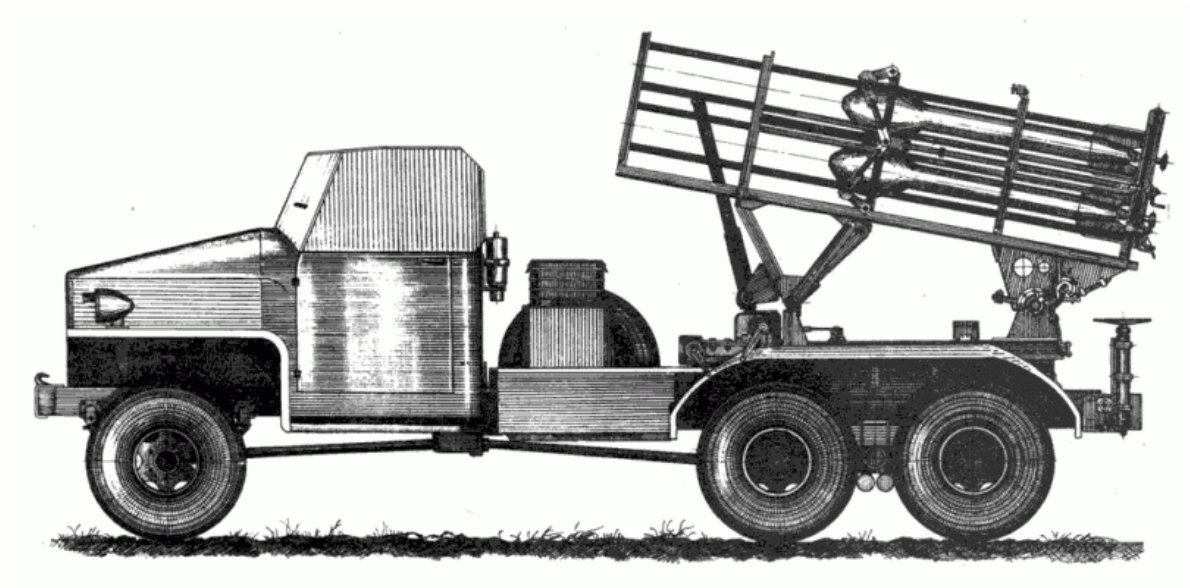
DRAWING OF THE BM-31 INSTALLATION FOR FIRING M-31
PROJECTILES FROM THE CAPPING



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INSTALLATION DRAWING M-31-12 (M-31, BM-31-12)

The advantages of the BM-31-12 installation in comparison with the M30 and M31 machines were:

- maneuverability (the possibility of experiencing);
- the ability to fire in the range of elevation angles from +10 to + 45 °;
- better accuracy of fire;
- the ability to move to a position charged;
- more convenient and faster loading with fewer numbers of calculation;
- exclusion of the projectile descent with the entrainment of the guiding closures [104].

Subsequently, the installation was used to launch M-13UK rockets of 132 mm caliber. In October 1944, in accordance with the TTT GUV GMCH KA, SKB specialists developed an insert for firing captured German 300 mm projectiles using BM-31-12 installations. the insert was put on the projectile and easily inserted together with the projectile into the guide through its breech. The inserts were protected by locking devices from moving during firing and from falling out after loading.

In May 1944, SKB specialists developed a 6-charge installation - the “M31 machine” of lightweight type. Based on the results of field tests, it was put into service.

In the summer of 1944, army inventors developed an original rocket system. CM. Shtemenko recalled: “... on the 2nd Belorussian Front, such a flying torpedo was designed, very simple in design. A round-shaped wooden barrel was attached to the M-13 rocket using iron hoops. Liquid thick was poured into the barrel. ... For stability in flight, a wooden stabilizer was attached to the tail section. The shooting was carried out from a wooden box with iron runners as guides…. ”[105].

The source [106] presents photographs of a flying torpedo

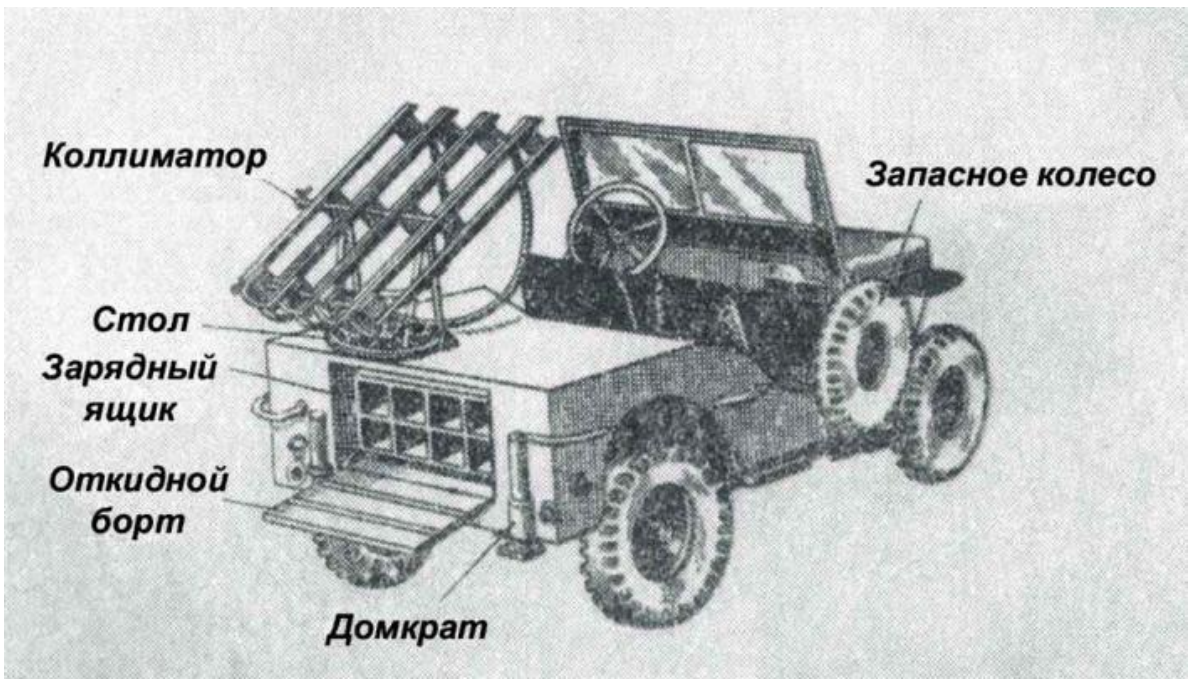
The source [106] presents photographs of a flying torpedo.

Decree of GKOK No. 6167ss “On arming the IL-2 aircraft with the installation for firing M-13 rockets” dated 07/11/1944, it was instructed “ *to take into account the message of the Air Force spacecraft Vorozheikin and Repin, and the People's Commissariat for Aviation Industry*

Shakhurdinai Ilyushin that the attack aircraft An IL-2 with a metal wing can be equipped with installations for firing standard M-13 rockets by replacing the suspended guides (RO beams) for M-8 projectiles with M-13 projectile guides on Il-2 aircraft, while maintaining, if necessary , the possibility of using M-8 shells by reinstalling the beams "[107].

In 1944, the modified Willys car chassis was used to mount the mining launcher and the charging box. The work was carried out by army specialists. The installations have been successfully used in the Carpathians.

According to the TsAMO RF, “on the initiative of the Commander of the 4th Ukrainian Front, General of the Army, Comrade PETROV, rocket launchers for action in the mountains - M-8-8, mounted on Willis vehicles, were developed and implemented [131].



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MINING RIG ON WILLYS CAR CHASSIS

Болгарское население сел Крен, Енина, Казанлешко с интересом рассматривает советский гвардейский миномет „Катюша“. Сентябрь 1944 г.

Из экспозиции
Военно-Исторического Музея Артиллерии, Инженерных Войск и Войск Связи (Россия, г.Санкт-Петербург).

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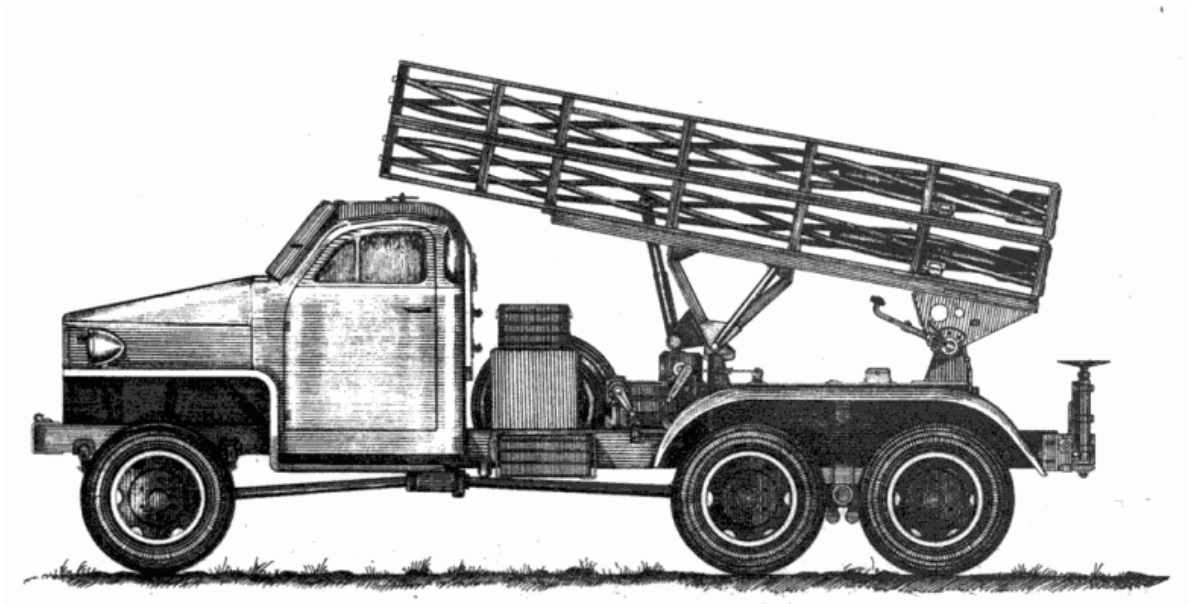
THE BULGARIAN POPULATION OF THE VILLAGES OF KREN, YENINA, KAZANLESHKO IS CONSIDERING WITH INTEREST THE SOVIET GUARDS MORTAR OF THE M-13 (OR M-13N) SERIES. SEPTEMBER 1944. *(FROM THE EXPOSITION OF THE MILITARY-HISTORICAL MUSEUM OF ARTILLERY, ENGINEERING TROOPS AND SIGNAL CORPS (VIMAIVIVS, RUSSIA, ST. PETERSBURG).*

A further improvement of the installations for firing 132 mm projectiles was the creation of the BM-

13-SN installation with spiral guides as part of the launching installation. In addition to cassettes with guides and trusses, all other units were unified with the corresponding units of the BM-13N normalized combat installation. With the help of the installation, it was possible to fire all types of 132 mm projectiles. The installation provided a significantly better accuracy of fire with M-13

projectiles - 3.2 times, M-13UK - 1.1 times, M-20 - 3.3 times, M-13DD - 1.47 times. It was simpler, less labor-consuming and cheaper to manufacture; in the manufacture of parts, there was no need for a number of labor-intensive machine work.



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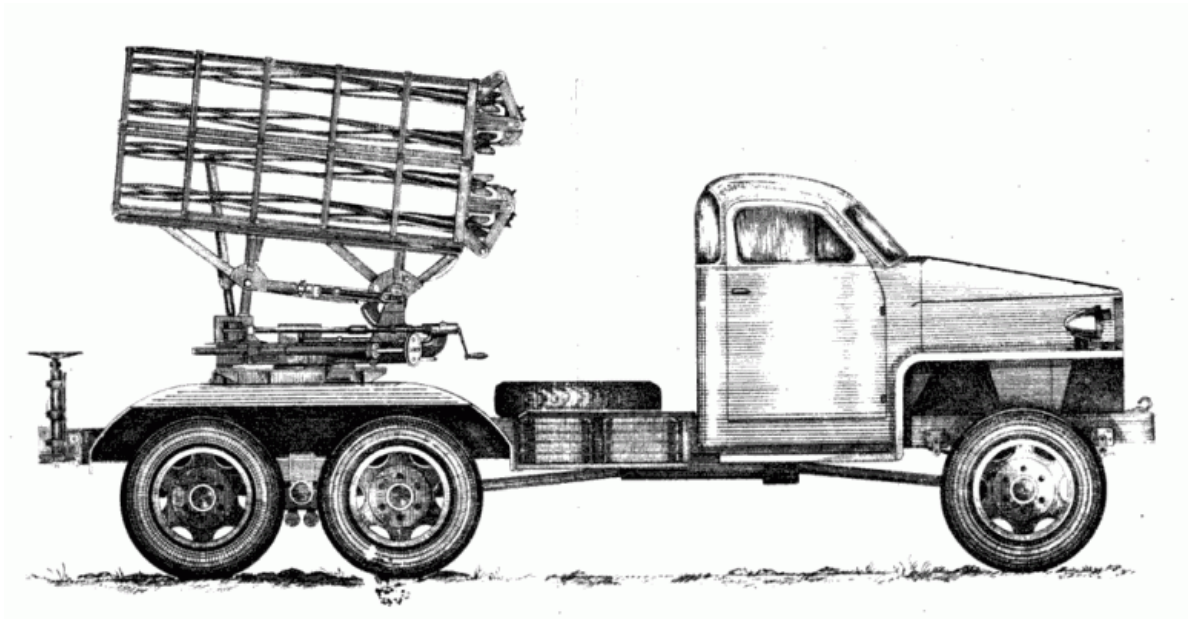
INSTALLATION DRAWING OF BM-13-CH ON A MODIFIED STUDEBAKER TRUCK CHASSIS

In 1945, BM-13-CH combat installations were manufactured for arming several divisions intended for the storming of Berlin [108]. After the end of the war, it was subjected to military trials, which showed good results, but due to the upcoming modernization of M-13 type rockets, it was not accepted into service and after the 1946 series was discontinued. However, in 1950, a Short Guide to the BM-13-CH combat vehicle was issued [109].

In 1944, after obtaining positive results in the accuracy of firing 132 mm projectiles from experienced spiral guides, SKB specialists, on their own initiative, began developing spiral guides for launching 82 mm M-8 projectiles. The advantages over the M-8 units with “beam” rails were:

- increasing the accuracy of firing with M-8 projectiles and reducing the dispersion area at an elevation angle of 45º - by 3.7 times, 25º - by 10.8 times, 11º - 8.5 times;
- the ability to fire through the cockpit in the range of +12 º and above;
- simplification of production;
- cheaper manufacturing, because a number of time-consuming machine-tool work has disappeared.



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A DRAWING OF THE BM-8-CH INSTALLATION ON A MODIFIED STUDEBAKER TRUCK CHASSIS

In 1945, several BM-8-SN units were manufactured at the Moscow Compressor plant, which were used to train the calculation numbers. In connection with the end of the war and the removal from

service of the M-8 projectile, the installation was not accepted for service [110].

In the period from December 1944 to February 1945, at the main Artillery Red Banner Proving Ground of the GAU spacecraft, ballistic firing of M-13-UK rockets was carried out . The objectives of the firing were: to study the effect of the charge temperature on the range and accuracy of M-13-UK projectiles ; study of the effect of the projectile weight on the flight range and the amount of derivation. The number of shots fired - 384 pcs. During the tests it was established:

"one. As the charge temperature rises, the range of the projectiles increases. Changing the charge temperature by 10 ° C, when firing at an elevation angle of 45 ° C, changes the range by 33 m or 0.42% of the range.

Lateral dispersion of shells decreases with increasing temperature of charges. With an increase in the charge temperature by 45 ° C, side scattering decreases by about 20%

2. With a decrease in the weight of the shells, their range increases.

A decrease in the projectile weight by 1% when firing at an angle of 45 ° causes an increase in the range by 60 m or 0.78% of the range of the range.

3. The magnitude of the derivation of the M-13-UK projectiles , in comparison with the scattering value, is insignificant ”[111].

In 1945, work was continued on captured jet ammunition [112].

In January 1945, at the Artillery Range of the Artillery Academy (Alabino station), a reconnaissance exercise was conducted for enemy rocket launchers. The objective of the exercise is “ *collecting experimental material on optical and sound reconnaissance of rocket mortars with its subsequent processing and drawing up military instructions for spotting rocket launchers with AIR* ” [113] (artillery instrumental reconnaissance).

“The conclusions on the Alabinsk doctrine, on the basis of the rich experimental material obtained, assert the full possibility of not only optical, but also sound reconnaissance of rocket launchers, moreover, even if there are records with poor or absent beginnings. The accuracy of the sound targeting was obtained within 14-30 small divisions of the protractor ”[114].

One of the TsAMO documents contains the following information on the mentioned issue.

“During the Great Patriotic War, and mainly immediately after its end, work began in the USSR to find means of reconnaissance of rocket launchers. To this end, on the instructions of the Commander of the Artillery of the Soviet Army, the Artillery Shooting-Tactical Committee / now NII-1 A.A.N, MVS / conducted two large exercises: the first - at the Alabinsky Proving Ground near Moscow in 1945 and the second at the Luga Proving Ground in 1946 with the involvement of all means of artillery instrumental reconnaissance. In addition, in 1947, in a somewhat smaller volume, similar exercises were conducted by the Higher Officers' Artillery School / VOASH /.

The conclusions of these exercises once again confirmed the position that the existing AIR methods and instruments are not suitable for reconnaissance of rocket launchers. This requires new methods and instruments.

The search for new methods of reconnaissance of rocket launchers / RU / is impossible without knowledge of those phenomena that can be used for reconnaissance of rocket systems. Initially, this work was delivered at NIIAP / now NII-5 AAN MVS /, and then in 1947 at GNIAP ”e. In view of the fact that NIIAP did not fully solve the set problem, a comprehensive study of all physical phenomena arising from a rocket shot was set up and practically, for the first time, started in 1947. on GNIAP ”e” [115].

The development of rocket artillery during the Great Patriotic War posed the task of artillery scientists to find ways to fire it. This task was set by N.N. Voronov and F.A. Samsonov. Studies have shown that " *for rocket artillery, the same basic methods are acceptable and quite effective as for cannon artillery* ." This was confirmed during the war [116].

Below are statistics on the production of M-13, M-8, M-20, M-30, M-31 shells. “During the Great Patriotic War of 1941-1945, the actual release of missile shells, on average per month, was:

for M-8 - 110,000 pcs

for M-8 - 110,000 pcs.

M-13 - 114,000 pcs.

M-20 - 12,000 pcs.

M-30 - 7.000 pcs. and

M-31 - 23,000 pcs.

The maximum release of these projectiles for individual months, already with expanded production, was:

for M-8 - 153,000 pcs.

M-13 - 168,000 pcs.

M-20 - 8.000 pcs.

M-30 - 600 pcs.

M-31 - 41,000 pcs. " [117]

For more information about the production of shells and their elements, see the galleries on our website (1 , 2 , 3 , 4).

One of the issues studied on rocket artillery after the end of the war was the issue of the consumption of rockets. The book "The Armament Service of Our Motherland for 600 Years" contains the following data:

Consumption of rocket shots (in volleys)				
	M-8	M-13	M-31	
Defeat of the Germans near Leningrad	-	10.6	one	TsAMO RF. F. 217. Op. 1236.D. 575.L. 42-57.
Grodno-Bialystok	0.6	3.8	12	TsAMO RF. F. 2. Op. 2465.D. 126.L. 27-30.
In Prussian 35f	8.4	7.8	four	TsAMO RF. F. 241. Op. 2643.D. 224.
Berlin operation 1 BF	9.2	9.4	3.0	
Berlin operation 1 Ukf	10.5	8.8	3.7	
Berlin operation 2 BF	2.9	3.9	1.5	TsAMO RF. F. 236. Op. 2647.D. 355.L. 15-26.

Volumetric consumption of rockets by years of war as a percentage:

1941 year	1942 year	1943 year	1944 year	1945 year
2,3	19.4	31.1	29.2	eighteen

"60% of the rockets were used up in 1943 and 1944. In terms of volume indicators, the industry has fully covered the need for reactive ammunition from the GMCh. They have used up 77% of the supplies" [133, p. 49].

In particular, for the Berlin operation, 24.17 thousand rockets were used [133, p. 47].

Both during the war and after it, new requirements for the models of rocket artillery began to form. It is enough, for a general understanding of this issue, information on this issue is provided in the Views on the report of the Lieutenant-General of Artillery Comrade Degtyarev and the meetings of the Deputy Artillery Commanders for GMCh of groups of forces and military districts

CONSIDERATIONS

According to the report of Lieutenant-General of Artillery Comrade Degtyarev and the training of the Deputy Artillery Commanders for the GMCh of groups of forces and military districts

1. It is premature to remove the M-8 systems from the armament of the GMCh. M-8 systems are an effective means of dealing with openly located infantry, as well as when operating in mountainous and wooded areas. The M-8 projectile is light, easy to manufacture, inexpensive, and can be produced in large quantities

can be produced in large quantities.

To improve accuracy, the M-8 CH combat vehicle has been worked out and tested. The accuracy of the M-8 shells when fired from this combat vehicle is improved by 4 times at the maximum distance.

A new M-8 projectile with a more powerful warhead is being tested. This projectile will have a wall thickness of about 14 mm (with a filling factor of 12%) and give a fragmentation effect equal to 85 mm of an anti-aircraft projectile of barreled artillery.

For action in the mountains, a light and convenient type of mountain mount M-8 was developed, tested and used in the last war, carried by soldiers or transported on packs. In the event that a decision is made to organize mining GMP, the production of mining installations can be quickly restored.

All the work being done to improve the M-8 projectiles and create installations for action in the mountains give full reason to believe that the M-8 system in service with the GMCh should still be preserved.

2. For operation in mountainous and field conditions, a universal M-11 system will be created, which will allow firing directly from a strong, cardboard cork. There is no need to create the M-13 system for mountainous conditions, since such a system would be cumbersome and heavy.

3. The BM-13-CH combat vehicle has been developed, tested and is being adopted, which is easier to manufacture, providing accuracy when firing with M-13 projectiles equal to the accuracy of M-13 UK projectiles.

BM-13 SN allows firing projectiles M-13, M-13 UK, M-20 and M-13DD.

When firing M-20 projectiles from the BM-13 SN system, the lateral accuracy increases by 3 times. When firing M-13DD projectiles from the BM-13SN, the lateral accuracy increases by 1.6 times compared to firing the same projectiles from the standard BM-13 combat vehicle.

4. Create an M-13 projectile with a range of 30-40 km. makes no sense, since the power of the M-13 projectile is small.

Work is planned to create a projectile with a range of 20-25 km. and the power of the M-31 projectile. This projectile most closely matches the requirements put forward by the meeting.

5. The following work has been done to improve the M-31 system: the M-31-12 combat vehicle with increased maneuverability has been created and put into service, allowing it to accompany the advancing troops and act in breakthroughs.

In order to improve accuracy (up to 1/100) and increase the range up to 6-7 km. The 4th Directorate of the GAU VS sets itself the task of modernizing the M-31 shells.

6. The question of creating the M-13 combat mount, which allows direct fire without preparing a special ramp, has been posed correctly. When developing TTT for the modernization of the M-13 and M-31 systems, this issue will be envisaged and combat installations of this type will be developed.

7. At this time (except those already published) is in press and the following manuals and instructions will be sent out shortly:

a) service leadership at BM-8-48

b) - " - - " - BM-31-12

Out of print and sent out in July 1946:

a) instructions for storing and preserving ammunition in arsenals, bases and district warehouses;

b) German powder rockets. Brief description and instructions for handling.

8. M-20 projectiles in service with GMCh should be retained as projectiles that give good results in accuracy when fired from M-13SN warheads, and very effective action at the target.

9. The possibility of building a parallel fan by mutual marking of combat vehicles will be provided for in the modernization of BM-13 and BM-31-12.

10. Proposals for the development of machine tools for firing M-13, M-20 and M-31 projectiles in cities and large settlements, as well as devices for carrying these projectiles in street combat conditions, will be included in the work plan of the 4th Directorate of GAU Sun.

11. Proposals for the creation of a device for the correct positioning of the ellipses of the M-13 and M-31-12 systems when solving shooting and artillery tasks will be included in the work plan of the 4th Directorate of the GAU Armed Forces.

p / n ZAM. Head of the 4th Directorate of the GAU AF
Major General Ing. art services -
(KUZNETSOV)

" 25 " July 1946. [118].

The proposals of the Main Artillery Directorate of the Armed Forces for a unified plan for experimental and research work on rocket powder for 1946-1947 provided for "... development of powder charges for standard M-8 and M-31 projectiles according to powder formulations for peacetime ...". As a result of the work carried out, “... powder charges for the M-8 and M-31 projectiles were to be developed, which do not contain magnesium oxide as a stabilizer and are suitable for long-term storage in warehouse conditions ...”. During the development, it was required “... to investigate the possibility of adding specially calcined magnesium oxide to ensure the stability of combustion ...” [119].

For other post-war plans for the development of rocket artillery, see our website: *TsAMO RF: From the plans for the development of rocket artillery in Russia after the Great Patriotic War of 1941-1945* .

In the period from 23-29 January 1947 “in the 1st training and test artillery battalion of the GAU VS” it was planned “to test wedges to reduce the lowest elevation angle of the BM-13 and BM-31-12 combat vehicles " [120].

Work in the field of rocket artillery as a whole in the period under review became the prerequisites for the creation of new models of the considered class of weapons, anti-tank missile systems, anti-aircraft missile systems, multi-barreled installations for arming ships of various displacement and aircraft missile weapons.

At the end of the article, we present the basic tactical and technical data of installations (combat vehicles) and rockets from various sources.

Table of tactical and technical data of combat vehicles of guards mortar units SVGK KA [121]

Description of characteristics	BM-13 on a car.	BM-13 on STZ-5 NATI	BM-8 to T-60	BM-8 on ZIS-6
Number of guides	16	16	24	36
The number of shells of one volley installation	16	16	24	36
Maximum firing range, m:				
a / projectile of normal range	8470	8470	5030	4800
used shell reduced range	4780	4780	-	-
The weight is finally gear. projectile in gr.	42750	42750	7025	7025
Fuse brand	GVMZ	GVMZ	AM-a	AM-a
Fuse settings	fragmentation / deputy.	fragmentation / deputy.	splinter.	splinter.
Projectile dimensions , mm: - length - diameter	 1500 132	 1500 132	 500/550 82	 500/550 82
The action of the projectile at the target when the fuse is set for fragmentation:				
- depth / diameter of the funnel	20/140	20/140	10/80	10/80
- zone of continuous defeat, m2	3300	3300	1000	1000
- range of dispersion of medium fragments, m	up to 150	up to 150	up to 35	up to 35

- scattering range of large fragments, m	up to 250	up to 250	up to 100	up to 100
The action of the projectile at the target when setting the fuse to delayed action:				
- funnel depth, m	0.85	0.85	-	-
- funnel diameter, m	2.80	2.80	-	-
The minimum time for the production of volleys, s	5-7	5-7	5-7	5-7
The time required to bring the installation "to battle", s	45-70	45-70	30-45	30-45
Time required for recharging (without travel), min	8-10	10-12	10-12	15-20
Installation weight, kg	5700	7800	5600	5300
Weight of the charged installation with calculation, kg	7000	9000	4500	6200
Dimensions, m - length - width - height	 6.40 2.28 2.80	 5.00 2.10 2.70	 4.10 2.30 2.40	 6.90 2.30 2.60
Maximum speed of a charged installation, km / h	40	15	25	40
Time required to occupy the OP with a 4.5 kilometer march, min	40-60	60-80	40-60	40-60
Time required to change the OP at a distance of up to 600 m with recharging installations, min	25-30	35-40	25-30	25-30
The time required for the GMCh division to occupy a battle formation, subject to preliminary reconnaissance of the terrain and a satisfactory road condition, hour	2-2.5	2.5-3	2-2.5	2-2.5
Time required to open fire on call / with a busy formation /, min	1-2	1-2	1-2	1-2
Box weight with shells, kg	130	130	65	65

The main characteristics of the M-31 and M-8 shells [122]

	M-31	M-8
Initial weight Go, kg	91.5	7
Weight at the end of combustion Gcon, kg	80.2	6
Charge burning time tay, s	0.8	0,4
Average weight consumption, kg / sec	14.1	2.5
Equatorial moment of inertia Jo at t = 0, kg • m • sec2	2.18	0.0133
Equatorial moment of inertia Jfin at t = tau, kg • m • sec2	0.04	0.0124
Change in the equatorial moment of inertia per unit of time ، kg • m • s	0.175	0.00225
Average reactive force, kg	2780	520
Average jet acceleration j, m / s	380	740
Length of direction l (probably meaning the length of the guide - *example of the author of the article*), m	2	2
Projectile speed when leaving the guide υo m / s	28.6	55
Projectile speed at the end of the active area / approximately /, m / s	300	300
Copper section area S, m2	0.0707	0.00528

The main characteristics of shells [123]

Projectile index	M-8	M-13	M-13UK	M-31	M-31UK

Ballistic index	TS-34	TS-13	TS-53	TS-31	TS-52
Caliber, mm	82	132	132	300	300
Reaction chamber diameter, mm	-	-	-	140	140
Weight of the finally loaded projectile with AM-A fuse, kg	7.92	-	-	-	-
Weight of the finally equipped projectile with a GVMZ fuse, kg	-	42.5	42.5	-	-
Weight of equipped warhead with fuse, kg	2.79	-	-	-	-
Weight of equipped warhead, kg		21.9	21.9	91.5	91.5
Burst charge weight, kg	0.6	4.9	4.9	28.9	28.9
Weight of the equipped jet engine, kg	5.13	20.6	20.6	39,7	41.3
Powder charge weight, kg	1.18	7.05-7.13	7.05-7.13	11.15-11.3	11.15-11.3
Projectile length without fuse, mm	675	1415	1415	-	-
Full length of a projectile without a fuse, mm	-	-	-	1760	1760
Wingspan (blades) of the stabilizer, mm	200	300	300	300	300
Burning time of a reactive powder charge, s	0.6	0.85	0.85	0.95	0.95
Average reactive force, kg	400	1650	1550	2320	2180
Descent speed of the projectile from the guide (muzzle velocity), m / s	fifty	70	65	40	35
Average projectile acceleration, m / s2	630	500	470	285	275
Maximum projectile speed, m / s	315	355	335	255	245
Length of the active section of the trajectory, m	80	125	115	115	110
The greatest range of fire, m	5515	8470	7900	4325	4000
Radius of continuous destruction by fragments, m	3-4	-	-	-	-
Radius of continuous destruction by shrapnel (when the fuse is set to "0"), m	-	8-10	8-10	-	-
Radius of actual destruction by fragments, m	12-15	-	-	-	-
The radius of the actual destruction by fragments (when the fuse is set to "0"), m	-	25-30	25-30	-	-
The dimensions of the funnel in the soil of medium hardness (when the fuse is set to "3"), m:					
diameter	-	2-2.5	2-2.5	7-8	7-8
depth	-	0.8-1	0.8-1	2-2.5	2-2.5
Mean deviation in range - Vd (at an elevation angle of 45 °), m	105	105	75	105	55
Median lateral deviation - Wb (at an elevation angle of 45 °), m	220	200	95	255	75

The performance data of the M-30 projectile of the increased range of the drawing TZ-0081 (experimental) [124]	
Head body weight, kg	10.8
Missile part weight, kg	30,680
Projectile body weight, kg	41.48
Rocket charge weight, kg	10.0
Burst charge weight in ammatol equipment (the underlined phrase is crossed out), kg	about 28
Weight of an incompletely equipped projectile, kg	79.48
Expected range, km	4.0-4.5
Accuracy	Vd / X = 1/50; Wb / X = 1/30
The shell head was made of 4 mm sheet. The rocket chamber was a chamber-nozzle unit and was made from a tube. The rocket charge consisted of 6 single-channel cylindrical sticks of nitroglycerin	

made from a tube. The rocket charge consisted of 6 single-channel cylindrical sticks of nitroglycerin powder with dimensions of 40 / 8-900 mm and a black powder igniter weighing 75 g.

Also see the electronic images of some resolutions of the State Defense Committee (GKO).

Date of the last changes: 05/08/2020

The shortened printed version of the article was published in the source: Gurov S.V. The development of rocket artillery in Russia in the 30s - 40s of the XX century // Proceedings of the Fifth International Scientific and Practical Conference (May 14-16, 2014) "War and Weapons. New research and materials ". In four parts. Part 1. - St. Petersburg: TsOP FGBU "VIMAIViVS" of the Ministry of Defense of the Russian Federation, 2014. - pp. 439-456.

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